SCIENCE

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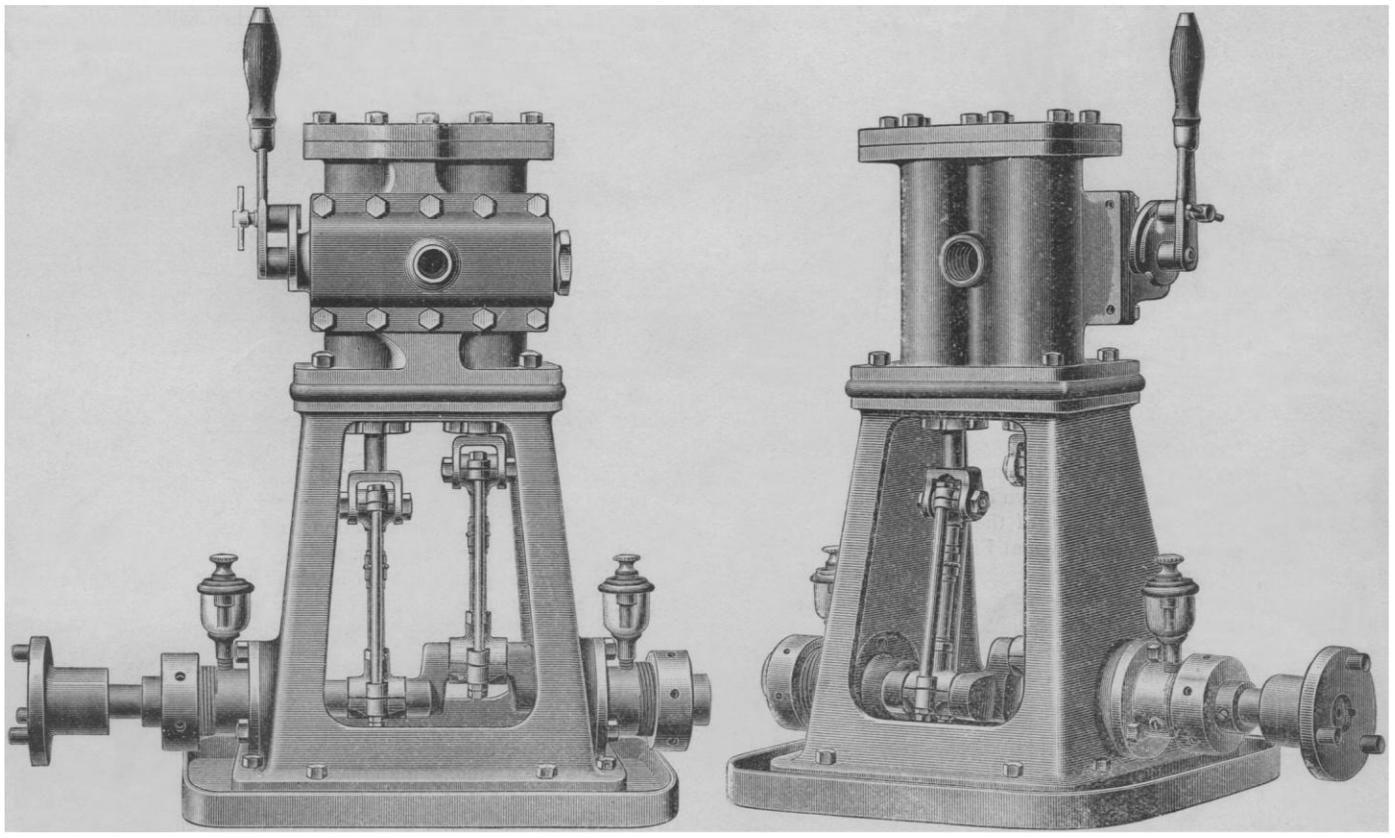
THE SHORTT HIGH-SPEED ENGINE.

THE new type of steam-engine illustrated on this and the following page possesses several points that will naturally attract the attention of engineers and steam-users generally. There are features about it that will specially commend it to marine engineers and yacht-owners, as well as to others interested in compact high-speed reversible engines giving a maximum of efficiency with a minimum of fuel, and as free from complication of parts as possible.



FIGS. 1 AND 2.—THE SHORTT DUPLEX HIGH-SPEED ENGINE.

The engine shown in the illustrations is known as the Shortt duplex high-speed engine, and it is being placed on the market by the Hussey Re-heater and Steam Plant Improvement Company of this city. Figs. 1 and 2 are perspective views of a reversing engine designed more especially for steam-launch and yacht service. Fig. 3 is a section showing the frame, cylinder and piston, steam-valve, connecting-rod, etc. It will be observed that there are two cylinders and a double crank, the crank-pins being set at an angle of ninety degrees with each other, thus preventing the engine from ever being on a dead-centre. The cylinders are made in one casting, and are supported on a frame of A-pattern, in which the best results as to strength and stiffness are got from a given weight of metal. The pistons are double-acting; that is, steam is admitted to them at each end of the stroke. An engine of this type, with cylinders two inches in diameter and two-inch stroke, will develop two horse-power under ordinary conditions, but with high steam-pressure it is capable of doing much more. A launch engine of this size and power, running at four hundred revolutions a minute, has been used to run a twenty-five foot launch during the past year with excellent results. Though the model of the boat is not one calculated for speed, it is said to have run along easily and continuously at a rate of ten miles an hour.

The valves, though cylindrical in form, are the same as the regular slide-valve in action and principle. They take their motion from the pistons, the piston and valve of the right-hand cylinder controlling the admission and cut-off of steam to the left-hand cylinder, and *vice versa*, the steam ports being crossed. Fig. 4 is a diagram of the valve-seat and ports, the dotted lines showing the crossed steam-passages. The steam-ports are designated by the letter *D*, and the exhaust ports by *C*. The valves are shown in Fig. 5, *E* being the reversing-valve, and *F* the main valves. The

steam-passages are shown at *G*, and the exhaust-passages at *H*. The reversing-valve acts inside the main valve, the reversal of the engine being effected by giving the inner valve a half-revolution in

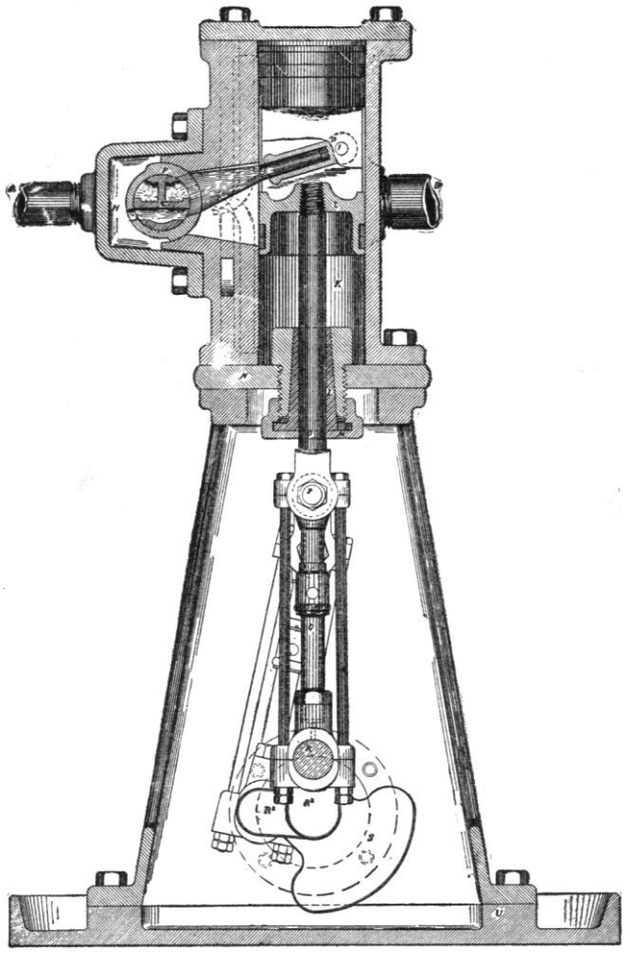


FIG. 3.

the outer valve, thereby changing the register of the steam-passages. The reversing-lever is shown in the plan of the valve-seat, Fig. 6. A cross-section of one of the main bearings with anti-friction metallic bushing is shown at Fig. 7. These bearings are

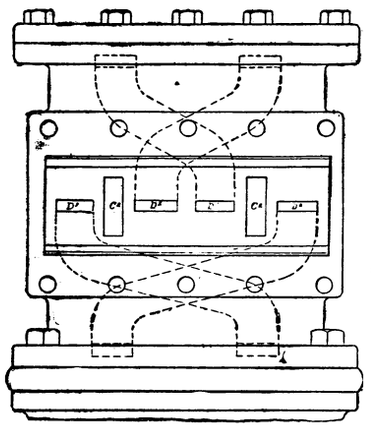


FIG. 4.

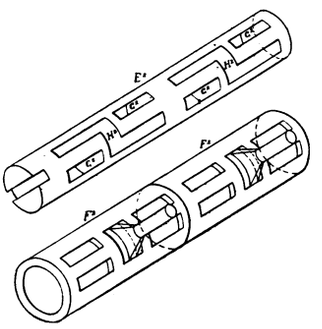


FIG. 5.

conical, and milled through, so that all wear may be easily and quickly taken up by turning the adjusting nut on the bearing casing. The connecting-rods are of the skeleton pattern, with self-oiling bronze boxes lined with anti-friction metal.

These engines are made by special tools in such a way as to insure that all like parts are interchangeable, thus facilitating repairs. The plain non-reversible engine made by the same manufacturers is the same as the engine shown, except that it has no reversing-

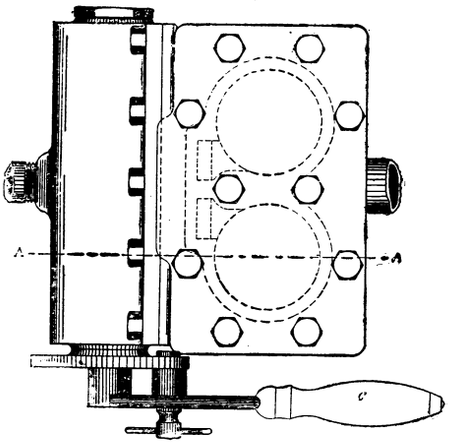


FIG. 6.

valve, and is provided with a pulley on the shaft instead of a coupling. In the larger sizes of these engines they will be made compound, and also automatic, special attention being paid to their adaptability for electric lighting and similar purposes. Among the advantages claimed for this engine are that it is economical,

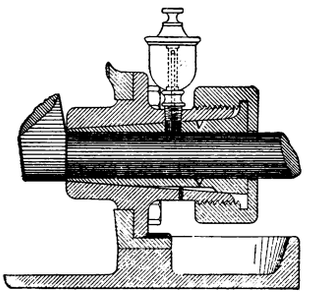


FIG. 7.

light, durable, simple in construction, and easy to operate, having no links, eccentrics, valve-stems, stuffing-boxes, nor dead-centres. It is said to afford greater power in smaller space than any other engine ever constructed, and to have the most positive valve-gear ever designed.

ELECTRICAL NEWS.

NEW INSULATING COMPOUND. — A new insulating compound which finds favor among manufacturers of electrical instruments and machinery in France consists of one part of Greek pitch and two parts of burnt plaster by weight, the latter being pure gypsum raised to a high temperature and plunged in water. The mixture, when hot, is a paste, and can be applied by a brush or cast in moulds. It is amber-colored, and can be turned and polished. Its advantage is said to be endurance of great heat and moisture without injury to its insulating properties.

ELECTRIC TRACTION. — A large and appreciative audience listened to the reading of a paper by S. Dana Greene, on the "Development of Electric Street-Car Traction," at a meeting of the New York Electrical Society on Dec. 11. In Mr. Greene's opinion, the storage-battery system of electric traction is the ideal one for roads of easy grades, though it is yet far from perfect. He predicts, however, that a few years more will develop a wonderful increase in its efficiency and reliability.

AGRICULTURAL RESEARCH ON THE PACIFIC COAST.

DURING the past summer Professor W. A. Henry, director of the Wisconsin Agricultural Experiment Station, was sent by the secretary of agriculture to the Pacific coast to report upon certain matters connected with agricultural research in that part of the country, and incidentally to look into the work of the agents of the department, and to ascertain the popular feeling regarding the character and importance of their work. The report has just been submitted to Secretary Rusk, and much of it will be of general interest, more especially as Professor Henry is a man of established reputation as an original investigator in practical agriculture.

In his report, Professor Henry states that several days were spent in visiting fruit-farms at various points in the vicinity of Los Angeles, and noting the destructive effects of the white scale and red scale, and the efforts in progress to check their ravages. At Orange, in Orange County, the destruction of citrus-trees by the red scale has been great, and only a few more years would suffice to leave that section without any such trees if remedies to check the destruction had not been put in operation the present season. The Santa Anna vine-disease has destroyed most of the grape-vines, and every orange-orchard shows in a greater or less degree the attacks from the red scale. Every stage, from thriftiness to death itself, was noted. In some orchards only the yellow-spotted character of the leaves showed the presence of the scale just beginning its fatal work; in others the ends of the branches were leafless and dead, the interior portions of the top yet carrying leaves, though little or no fruit. Still other orchards had but the stumps of the orange-trees left, all of the limbs to the size of one's arm having been killed by the scale, and removed with the saw. From these stumps green shoots showed signs of life, and, if care was given, promised to renew the value of the orchard. The careless treatment of the land showed as plainly as the trees themselves the discouragement of the people.

Usually an orange-orchard in southern California receives the best of care, and the carefully tilled soil lying loose, without a weed in sight, and as level as a floor, delights the lover of thrift and good tillage. In many orchards weeds cover the ground, and form thickets five or six feet high, so dense that a man can hardly get through them. The dead and dying orange-trees among these weeds stand like monuments marking the deadly march of the insidious, insignificant, but wonderfully fatal scale. Professor Henry visited an orchard in which Mr. Coquillett was conducting spraying experiments with resin-soap solutions, and he also visited many other groves in all stages of thrift and decay, from those bearing heavy crops to those with nothing but the stumps standing. It was very apparent that those who had fought this scale the most vigorously, even though very imperfectly heretofore, are coming out the best in the end, and that those who early gave up and neglected their orchards will suffer far the most heavily. One orchard near the California Central Railroad station, at Orange, of 850 seedling trees, showed the ends of the branches already dead; and there were scales enough on the leaves to so reduce the vitality of the trees the present season that by next spring most of the trees would have to be cut back to mere stumps. A few weeks before the visit the owner plucked up courage, and sprayed the trees with the resin-soap compound in a very thorough and systematic manner, the whole operation costing, for the 850 trees, $200. Professor Henry spent an hour in observing the effects of the wash, and estimated that more than 95 per cent of the scale had been destroyed, while not one leaf in ten thousand had been injured in the least by the wash. Mr. Hamilton stated that resin was now being brought to Orange by the car-load for the purpose of making the resin soap. For the first time people are really taking heart, and are going at their orchards in dead earnest to make them profitable once more. The plough had been set to work to reduce the weeds and bring back the old-time thrift in many cases, though some orchards were yet as desolate as ever. Before speaking further in regard to remedies for the red scale, the destruction of the cottony-cushion scale should be noted.

In studying this insect, Professor Henry first visited the place of Mr. William Niles, in Los Angeles, where the "lady-bug" (*Vedalia cardinalis*) was being propagated by the county insect commission for dissemination among the orange-groves infested with the cottony-cushion or white scale. He found five orange-trees standing about eighteen feet high, enclosed by walls of cheap muslin supported by a light framework of wood. The orange-trees inside this canvas covering had originally been covered with the white scale, but the *Vedalia* which had been placed on these trees were rapidly consuming the last of the pests. Entering one of these canvas houses, he found the *Vedalia*, both larvæ and adults, busy consuming the scale. Here and there on the canvas were the beetles endeavoring to escape to other trees. These insectaries were in charge of Mr. Kircheval, one of the county insect commissioners, who kept a record of the distribution of the beetle. It was indeed a most interesting sight to see the people come, singly and in groups, with pill-boxes, spool-cotton boxes, or some sort of receptacle in which to place the *Vedalias*. On application, they were allowed within the insectaries, and each was permitted to help himself to the beetles, which were placed in the boxes and carried away, to be placed on trees and vines infested by the white scale at their homes. Mr. Kircheval kept a record of the parties and the number of beetles carried off. The number coming for the *Vedalia* was surprisingly large, — scores in a day, — and each secured at least a few of the helpful beetles. That the supply should hold out under such a drain was a great surprise, and speaks better than words the rapidity with which the *Vedalia* multiplies when there are scale insects enough to nurture the young.

Professor Henry also visited other points, Lamanda Park, Santa Anita, Sierra Madre Villa, Pasadena, etc. At the time of his visit to Sierra Madre Villa, Aug. 23, the white scale had already disappeared before the *Vedalia*. At Santa Anita, the ranch of Mr. E. J. Baldwin, he examined a 350-acre orange-orchard, in which the white scale had started a most destructive course. Mr. Baldwin began an equally vigorous defence, going personally into the orchard and superintending the work of fighting the white scale. There was every sign, however, that the scale was going to be the victor. Some of the trees were almost ruined by the severity of the application made. Happily, before the pest had gone far in its work, the *Vedalia* was heard from, and Mr. Baldwin secured a number, which were placed in the hands of one man specially detailed to look after its welfare. This individual spent six weeks in colonizing the *Vedalia* in various parts of the orchard. After that time, a careful examination showed the superintendent that the work of colonizing was so complete that further effort in that line was unprofitable. It was predicted at the time of the visit that a few weeks more would leave the orchard entirely free from the white scale. At Chapman's he found the citrus-orchard, formerly so famous, entering the death stages from the white scale, which was now fortunately being so effectually checked. At Pasadena, on the grounds of Professor Ezra Carr, he found that some of the shrubbery had been seriously injured by the white scale, but, thanks to the *Vedalia*, not a single pest was alive at the time of his visit.

A word in relation to the grand work of the department in the introduction of this one predaceous insect. Professor Henry thinks it is without doubt the best stroke ever made by the Agricultural Department at Washington. Doubtless other efforts have been productive of greater good, but they were of such character that the people could not clearly see and appreciate the benefits, so that the department did not receive the credit it deserved. Here is the finest illustration possible of the value of the department to give people aid in time of distress; and the distress was very great indeed. Of all scale pests, the white scale seems the most difficult to cope with; and, had no remedy been found, it would probably have destroyed the citrus industry of the State, for its spreading to every grove would probably be only a matter of time.

At Sierra Madre Villa, in the orchard of W. D. Cogswell, a chalcid fly was found to be parasitic on what is there called the red scale. In company with the county insect commissioners and Mr. Coquillett, Professor Henry visited this orchard. It was quite evident that the so-called red scale of this orchard has been greatly checked, and may yet be entirely destroyed, by the chalcid. At E. J. Baldwin's the commission also found the same scale being destroyed by the same parasite. In this case each parasite destroys

but a single insect, and the commissioners were very solicitous and also sceptical as to its ability to rapidly destroy the red scale. Furthermore, they questioned whether the chalcid would destroy the true red scale, as they did not believe that the scale on the orchards mentioned was identical with that about Orange. The *Vedalia* has brought the people a simple, rapid, and effective remedy for the white scale, and the commission was very solicitous lest the people should give up the use of washes for the red scale, and wait for the spread of the chalcid parasite. If the parasite should multiply but slowly, which seems probable, the red scale would be enabled to spread and do great harm before overtaken. It is of the highest importance, at this time, that a constant fight against this scale should be made; and there should be no halting, even if imperfect means of holding the pest in check are only at hand.

Professor Henry carefully examined the experiments conducted by Mr. Coquillett with resin washes, and considers that he has used excellent judgment in the manner in which he has conducted them, and thinks he plans his spraying experiments carefully and with good judgment, and carries them through with thoroughness to the end.

It seems of the highest importance that experiments with washes be prosecuted, and that the great advance of the last year be followed up vigorously. With the resin washes for the red scale, and the *Vedalia* for the white scale, the citrus industry will again move forward, and people have the confidence in it of former days.

CAUSATION OF HOG-CHOLERA.

INVESTIGATIONS of the epizootic diseases of swine, occurring in the neighborhood of Baltimore, have been made by Professor William H. Welch, M.D., with the co-operation of A. W. Clement, V.S., and F. L. Russell, V.S., in the Pathological Laboratory of the Johns Hopkins University during the past two years. They examined about fifty hogs, from six herds, affected with hog-cholera, as well as several isolated cases. Only a summary of the most important results will be given here, a fuller report being in preparation for the volume of studies from the Pathological Laboratory, to be issued by the Johns Hopkins Hospital.

The most common and characteristic lesions, as given in the *Johns Hopkins Bulletin* for December, consisted in superficial and deep necroses, either circumscribed or diffuse, of the inflamed mucous and other coats of the large intestine, associated often with superficial branny diphtheritic exudation. Similar necroses were occasionally found in the stomach and small intestine, in the mouth, palate, and epiglottis, and less frequently in the gall-bladder, bile-ducts, and preputial sac. Some form of pneumonia was usually, although not constantly, present. In a few cases pneumonia was present without intestinal lesions; more frequently intestinal lesions were observed with little or no pneumonia. Strongyles in the bronchi were rarely missed. Bronchitis was the rule. Pleurisy was common; pericarditis and peritonitis were present in the minority of cases. Redness of the skin was common, but inconstant. The subcutaneous, mediastinal, and abdominal lymph-glands were usually swollen and reddened, chiefly in the periphery. The spleen was often normal, but in many cases was moderately and sometimes extremely swollen. The kidneys were either normal or the seat of hemorrhages and of parenchymatous degeneration or nephritis. The liver was often normal, but sometimes it presented necrotic areas. Ecchymoses were often observed in the gastric and intestinal mucosa and beneath the epi- and endo- cardium. In some cases all of the organs of the body were studded with small hemorrhages.

The bacteriological examination consisted in the study of cover-glass preparations from the different parts of the body; in the inoculation of animals, either white mice or rabbits, with parts of the lung, spleen, liver, intestine, and sometimes other organs; and in the preparation of Esmarch roll cultures, usually of agar, from the blood, intestinal contents, and all of the principal organs of the body.

Of the bacteria isolated in pure culture and observed in microscopical preparations of the tissues, only two species were sufficiently common or had such distribution as to suggest an etiological relation to the disease. These are the so-called hog-cholera bacillus and the swine-plague bacillus; the former first described in the "Report of the Bureau of Animal Industry for 1885" as the bacterium of swine-plague, and in the report for 1886 as the bacterium of hog-cholera, — a change of nomenclature due to the detection in certain diseased swine in this country of the latter organism, which now received the name of the "bacterium of swine-plague," as it was believed to be identical with the micro-organism previously described by Löffler and by Schütz as the specific cause of Schweine-Seuche in Germany.

The bacilli of hog-cholera are short rods with rounded ends, averaging 1 μ – 2 μ in length and about 0.6 μ in breadth, but forms both longer and shorter than these measurements may occur. They are very actively motile. They grow readily on all of the ordinary culture media, and best at temperatures between 30° and 38° C. They do not liquefy gelatine. The growth on gelatine and on agar has a grayish or whitish color, often with a bluish translucence. Bouillon cultures present a diffuse cloudiness with whitish sediment and without surface membrane. The growth on potato assumes generally a brownish or yellowish tint, but it may be white, and sometimes is indistinct, although microscopically the growth is abundant. The bacilli are killed by exposure for ten minutes to a temperature of 58° C. In cover-glass preparations from the fresh juices and tissues of animals dead of hog-cholera, the bacilli stain readily, and for the most part uniformly, with aniline-oil gentian-violet. If the stained specimen be treated with acetic acid, many of the bacilli appear with clear centre and stained margin, which may be either uniform or slightly thicker at the poles, as described in the reports of the Bureau of Animal Industry. Some may present a typical polar staining, but they are not regarded as good polar staining bacilli, like those of swine-plague. Various irregularities in staining appear in old cultures.

The hog-cholera bacilli are pathogenic for rabbits, mice, guinea-pigs, and pigeons. Only the experiments with rabbits will be described here. These animals, when inoculated subcutaneously with a platinum loop from a pure culture of hog-cholera bacilli, die usually in from six to eight days, but the duration of life may be shorter or longer. There is generally considerable dry purulent infiltration at the seat of inoculation; the subcutaneous lymphatic glands on the same side are enlarged, and often present necrotic foci; the spleen is swollen, as a rule extremely, and of a dark red color and firm consistence; the liver generally presents yellowish-white streaks and dots; the heart-muscle is fatty; and in some cases ecchymoses, necrotic patches, and diphtheritic exudation may be found in the intestinal mucosa. The bacilli, which often occur in clumps, are found most abundantly at the seat of inoculation, in the affected lymph-glands, the spleen, and the liver, and are often so scanty in the blood as to escape detection by microscopical examination. The statements in the reports of the Bureau of Animal Industry of the effects of these bacilli when inoculated in pigeons have been confirmed by Professor Welch.

The swine-plague bacilli are shorter than the hog-cholera bacilli. Measuring on the average 0.8 to 1.4 μ in length, they may be very small, and present the appearance of slightly oval bodies, more like cocci than bacilli; or, on the other hand, they may present themselves as rods of considerable length. In appearance and other properties, they belong to the same group of organisms as the well-known bacteria of chicken-cholera and of rabbit septicæmia. They are devoid of independent motion. They grow on the ordinary culture media, with the exception of potato, but at ordinary temperatures the growth is less rapid and abundant than that of the hog-cholera bacilli. They do not liquefy gelatine. On gelatine and agar the growth is grayish, translucent, not extending far from the point of inoculation. Bouillon cultures are sometimes diffusely cloudy; but more frequently the growth is in the form of a whitish, rather viscid sediment, or in little specks, with clear fluid. When planted on potato, there may be a feeble invisible growth for one or two generations, probably due to the transferrence of a little nutritive medium to the potato with the organisms. We have not been able to cultivate them for several generations upon potato. They are killed at a temperature slightly lower than that destructive to hog-cholera bacilli, and their vitality in cultures is much shorter than that of hog-cholera bacilli. In cover-glass prepara-

tions from the fresh juices aud tissues of animals dead of swine-plague inoculations, the bacilli present an exquisite and typical polar staining, unless the forms are very short, when the staining is uniform. They are pathogenic for rabbits, mice, guinea-pigs, pigeons, and bats. Two degrees of virulence in this organism have been met. The one kind kills rabbits in from sixteen to thirty hours, with enormous multiplication of the bacilli in the blood and organs: the other kind destroys life in from two to six days, occasionally longer, with extensive purulent and serous infiltration at the seat of inoculation, often with peritonitis, and with frequently few bacteria in the blood and organs, but an immense number in the inflammatory exudates.

Regarding the distribution in the diseased hog of these two species of bacteria, great variety exists, which cannot be fully described in this short communication. In some cases the hog-cholera bacilli have been found abundantly in the blood, intestine, and all of the organs: in other cases they have been present only in certain parts, most frequently the spleen and liver, and absent in other parts. They may be absent from the spleen when abundant elsewhere, as in the kidney.

The swine-plague bacilli, when present, likewise vary in different cases in their distribution. They are most frequently found in hepatized areas in the lungs, but they may also exist in the intestine, the blood, and various organs.

As regards the frequency with which each of these organisms has been found in the diseased hogs, the following groups of cases have been met: first, herds of diseased swine, in which only the hog-cholera bacillus has been found; second, herds in which only the swine-plague bacillus was present; third, herds in which both the hog-cholera bacillus and the swine-plague bacillus were present in the same animal, or the hog-cholera bacillus in some animals and the swine-plague bacillus in others of the same herd. A few, chiefly scattered cases, in which neither the hog-cholera nor the swine-plague bacillus was found, were met.

Professor Welch and his co-workers have not been able to establish any constant anatomical differences between the cases in which the swine-plague bacilli alone were present and those in which only hog-cholera bacilli or both organisms were found. While they have frequently found only the swine-plague bacilli in extensive hepatized areas in the lungs, they have also sometimes found the hog-cholera bacilli alone in apparently similar pneumonias. They have not met any epizootic corresponding to the German Schweine-Seuche in which pneumonia existed in any large number of cases without intestinal lesions.

With these results, they naturally looked with especial interest to the effects of inoculation of healthy hogs with pure cultures of each of these organisms. The most stringent precautions were taken in the selection and care of the experimental hogs.

Two hogs, weighing about 75 pounds, not subjected to any preliminary treatment, were fed each 225 cubic centimetres of bouillon culture of hog-cholera bacilli. The one died in four and the other in eight and a half days with extensive diphtheritic inflammation and superficial circumscribed necroses of the large intestine, with moderate swelling of the spleen and of the lymphatic glands, and with ecchymoses in the lungs and elsewhere. Strongyles were present in the bronchi, but there was no pneumonia. Hog-cholera bacilli were found in abundance in the blood, intestine, and organs. In a third hog 6.5 cubic centimetres of the same bouillon culture were injected with antiseptic precautions into the duodenum. Death occurred in seven days with the same lesions as in the preceding hogs. Two hogs exposed in the same pen with the first hog were sick for a number of days, and gradually recovered. These, when killed, presented undoubted evidence of the previous existence of acute diphtheritic inflammation of the large intestine.

The injection into the thigh and into the lung of 5 cubic centimetres of the same bouillon culture in two other hogs produced only localized sloughs with slight constitutional disturbance. The hogs were killed at the end of five weeks, and hog-cholera bacilli were found alive in the sloughs, but none elsewhere in the body.

The injection into the right lung of a pig of 8 cubic centimetres of a pure bouillon culture of swine-plague bacilli was followed in from forty-eight to sixty hours by death with extensive pneumonia, double fibrinous pleurisy, pericarditis, and peritonitis, and with very abundant swine-plague bacilli in the exudates, the blood, and the organs. Intestinal lesions were absent. The injection of 0.5 of a cubic centimetre of bouillon culture of swine-plague bacilli into each lung of another pig was followed by great rapidity and difficulty of respiration, and coughing. The animal was killed at the end of a week. Double sero-fibrinous pleurisy and pericarditis and foci of pneumonia were found. The swine-plague bacilli were present in abundance, The injection of pure cultures of swine-plague bacilli with a fine hypodermic needle into the peritoneal cavity was not followed by any manifest effects; but in two cases in which laparotomy was performed with antiseptic precautions, and pure cultures of swine-plague bacilli (6.5 cubic centimetres) were injected into the duodenum, the animals died in from sixteen to thirty hours with acute diffuse peritonitis, pleurisy, and pericarditis, and an enormous number of swine-plague bacteria in the exudates, blood, and organs, but without intestinal lesions. Doubtless some of the culture escaped into the peritoneal cavity. Subcutaneous inoculations in two cases, and feeding in four cases, of swine-plague cultures, produced no lesions, save localized abscesses and sloughs after the injections.

It is evident from these experiments that both the hog-cholera bacilli and the swine-plague bacilli are pathogenic for swine; that the former, when fed or injected into the duodenum, even in comparatively small quantity, are capable of producing intense diphtheritic inflammation and necrosis of the large intestine with general infection, and the latter, when injected into the thoracic cavity or into the injured peritoneal cavity, of causing pneumonia and inflammation of serous membranes.

If, as seems probable from these observations and experiments, the hog-cholera bacilli are to be regarded as the cause of hog-cholera, at least of the intestinal lesions, how is the failure to find these bacilli in a number of cases of the disease to be explained? A number of possibilities suggest themselves. First, the bacilli may be confined to the intestine, and mixed with so many other bacteria that it is difficult or impossible to isolate them. Their morphology and the appearance of their colonies are so little characteristic, that this might readily happen. That this, however, cannot always be the explanation, is evident from the fact that in several instances rabbits inoculated with typical necrotic buttons have survived, and cultures and inoculations from other organs have failed to reveal the bacilli of hog-cholera. Second, the bacilli may be confined to the intestine, and so modified that they fail to kill rabbits when inoculated subcutaneously. These bacilli appear to vary somewhat in their virulence, and the possibility suggested cannot at present be disproven. Third, as in cases of typhoid-fever and croupous pneumonia in human beings, the specific bacilli may disappear in the later stages of the disease. This explanation, which is suggested in the reports of the Bureau of Animal Industry, seems probable, but, as already mentioned, the investigators have not been able to distinguish anatomically cases in which hog-cholera bacilli could not be detected from some of those in which they were present.

It is not clear to them what *rôle* is to be assigned to the swine-plague bacilli in the natural infections which they have studied. The facts that experimentally the swine-plague bacillus is capable of causing extensive pneumonia and inflammations of serous membranes, and that epizootics occur in swine in Germany with these as the predominant lesions without intestinal disease, suggest that this organism, which is apparently identical with that of the German Schweine-Seuche, is also the cause of a similar affection in this country. They are not, however, aware that any swine epizootic of pneumonia without any intestinal lesions, and with the sole presence of the swine-plague bacillus, has been observed in this country, although cases of this description occur scattered in epizootics of hog-cholera with intestinal lesions. Until such an epizootic is observed in this country, it is not likely that the question will be thoroughly elucidated as to the *rôle* of the swine-plague bacilli. It is possible that the swine-plague bacilli are frequently present in the mouth, the air-passages, or the intestine of healthy hogs, analogous to the frequent presence of the micrococcus of sputum-septicæmia and of pneumonia in the mouth of human beings, and that in the mixed infections which have been observed

the widespread diffusion of the swine-plague bacilli is due to secondary invasion following infection with the hog-cholera bacilli. This, however, does not remove the grave significance of the swine-plague bacilli, which certainly cannot be ignored in the studies in this country of the diseases known as hog-cholera or swine-plague.

While differing in some points from the conclusions reached by the workers on this subject in the Bureau of Animal Industry, great pleasure is taken in recording the essential harmony of the observations here made with the facts which they have observed in their painstaking and creditable investigations of this difficult subject as reported since the year 1885.

Through the kindness of Dr. F. S. Billings, Professor Welch has had the opportunity of examining a number of cultures from diseased swine in Nebraska, chiefly direct cultures from the spleen. These in nearly all instances were pure cultures of the hog-cholera bacillus. Much confusion has resulted from Dr. Billings's attempt to identify this organism with that of Schweine-Seuche.

The former has had the opportunity of examining cultures of Schweine-Seuche and also of the Scandinavian swine-pest, obtained from the Hygienic Institute in Berlin. The organism in Schweine-Seuche cultures is apparently identical with the swine-plague bacillus which he has isolated. The organism in the swine-pest cultures is a different species of bacillus, and appears to resemble closely, if it is not identical with, the hog-cholera bacillus.

It is regarded of importance that the future study of swine affected with hog-cholera or swine-plague should be accompanied with a more thorough bacteriological examination of each case than has hitherto been customary. The mere production of a direct stab-culture from one organ, such as the spleen, or the mere inoculation of an animal with material from one organ, affords very incomplete and unsatisfactory information. So long as the relations of the two organisms — the hog-cholera bacillus and the swine-plague bacillus — to the diseases of swine are not thoroughly clear, it seems necessary to make Esmarch or plate cultures from the blood, the intestine, and the principal organs of the body, and also to inoculate animals with material from the lungs, spleen, intestine, etc. A single case thoroughly investigated according to modern bacteriological methods is of more value than many cases in which only stab-cultures have been made from one or two organs, or in which reliance is placed solely on the results of inoculating animals. Little reliance can be placed upon the results of experimental inoculations of swine with the suspected organisms of hog-cholera and of swine-plague in regions where the disease prevails, unless very strict precautions are taken in the selection and care of the experimental animals.

RUMINATION IN THE HUMAN SUBJECT.

IN the *London Medical Recorder* for Nov. 20, 1889, Dr. Ireland summarizes the contents of a paper on this curious phenomenon by Dr. Sievers in the *Finska Läkaresällskapets Handlingar*, No. 5, 1889.

This author first gives a *résumé* of the different opinions upon rumination since 1618 (when Fabricius ab Aquapendente published the first case of this affection) until the present time. He recalls that since the appearance of the classical work by Adrien Dumur on the "Paralysis of the Cardiac Orifice or Merycism," the most recent authors see in this affection a nervous moving of the stomach accompanied by more or less diminution of the tone of the cardiac orifice. He thinks, however, that the true nature of rumination has not yet been thoroughly studied. Like Johannessen, to whom we owe the most detailed examination of this subject, Dr. Sievers says, that, before drawing any conclusion, the details should be more minutely studied. But while the researches already made do not explain satisfactorily the nature of rumination, they furnish us with very important facts for the therapeutic treatment.

Dr. Sievers publishes three cases of rumination which he observed in private practice at Helsingfors. Besides these, so far as he knows, there are only three other cases of rumination mentioned in Scandinavia, and reported by Johannessen in *Zeitsch. für klin. Medicin*, Bänder X. and XII. In the first case described, the patient, aged twenty-seven, who had been a governess and sick-nurse, belonged to a very nervous family, though none of them suffered from insanity or any other grave disorder. She had previously enjoyed good health. She always ate very quickly, and did not properly masticate her food. It is now ten years since she commenced to ruminate her food, after a sea-voyage lasting from three to four days, during which time she had not defecated, owing to want of convenience. Five, ten, or thirty minutes after eating, the food is collected in little balls in the mouth in order to be subjected to a second mastication. The patient seems quite at ease during rumination. After an ordinary dinner the rumination lasts from an hour and a half to two hours. If she moves about, or even if she is disturbed, rumination begins sooner, and is more active. Trying to restrain the process brings on such distress that the patient is compelled immediately to give in. During rumination she prefers to be seated. She leans forward, and at every mouthful which returns she lowers her head.

On scrutinizing the abdomen during the act of ruminating, one notices a dimple-like depression under the ribs. This is accompanied by an uneasy sensation passing from right to left. This does not extend farther than about the cardiac orifice. The patient feels a slight shock, and the food returns to the mouth. The stomach was found to be moderately distended with air. There was no retardation of digestion, and no excessive secretion of gastric juice; but there was found to be unusual acidity of the contents of the stomach, owing to the increased production of hydrochloric acid. No lactic acid could be detected. For this patient Dr. Sievers prescribed a teaspoonful of Carlsbad salts before dinner and supper, and a teaspoonful of bicarbonate of soda after each meal. The diet was to consist of milk, eggs, meat, and a very little bread. Under this treatment there was a gradual improvement; and at the end of five weeks the rumination had entirely ceased, nor did it return after she had discontinued using the alkalies.

The second case was a priest sixty years old. He had always ruminated. His father, now eighty-eight, did the same. The process commenced after a meal, and lasted from two to three hours. He never tried to stop it, and does not think he could, as it goes on independently of his will. He did not desire medical treatment with a view to remove it.

The third case was a Jewess, thirty-five years old, of a highly neurotic family. Her father also ruminated; and one brother out of the family of nine occasionally did the same. She herself has ruminated from childhood. The food returns of itself. The act causes her no uneasiness, which would not be the case if she tried to resist it. She did not desire medical treatment. The contents of the stomach were found to be very acid.

In *La Psichiatria* (Fasc. III.–IV.) there is a paper on "Rumination," by Dr. Cantarano. He had opportunities of studying this affection in four idiots, two imbeciles, and three patients deeply demented. No uneasiness seems in these cases to have followed the process. Dr. Sievers, among other contributions to this curious subject, refers to the papers of Alt (*Berl. klin. Wochensch.*, 1888, Nos. 26 and 27) and of Boas (No. 31 same journal); and in the *Archives de Neurologie* (VII. 1884) the reader will find an interesting paper on "Merycism," by Drs. Bourneville and Séglas.

HIGHWAY IMPROVEMENT.

IN an address on highway improvement delivered before the Carriage Builders' National Association at Syracuse, N.Y., recently, Col. Albert A. Pope of Boston said that the best roads in the world to-day are those of England, France, and Germany, their excellence being due to the fact that those countries were the first to awaken from the long sleep of the dark ages, and that the growing rivalry between them necessitated attention to their roads, for the proper prosecution of both their military and their mercantile interests. In each country the roads early came under the national supervision, the results of which are seen in the most splendid highways in existence, costing the least to maintain, and in every way the most satisfactory and economical for those who use them.

No country has a greater road mileage in proportion to the population than the United States, according to Col. Pope; but while, with characteristic American push and hurry, the more extensive means of communication and intercourse have been provided, we

have suffered the consequence of a lack of any general system of public policy covering the location, construction, and maintenance of roads. American roads are far below the average: they certainly are among the worst in the civilized world, and always have been, — largely as a result of permitting local circumstances to determine the location, with little or no regard for any general system, and haste and waste and ignorance in building.

Among the benefits attendant upon the proper construction and maintenance of roadways, the speaker mentioned the following. Good roads attract population, as well as good schools and churches, and they improve the value of property; so that it is said a farm lying five miles from market, connected by a bad road, is of less value than an equally good farm lying ten miles away from market, connected by a good road. A larger load can be drawn by one horse over a good road than by two over a bad one. Good roads, consequently, encourage the greater exchange of products and commodities between one section and another, besides being of great value to railroads as feeders.

As one solution of the road problem, Col. Pope outlined the following plan. A commissioner of highways might be provided for, in the Agricultural Department, with a corps of consulting engineers, and suitable appropriations made for the prosecution of a general supervising work. Under the charge of this commission, full systems of maps should be prepared; based largely, perhaps, upon the working of the state and county boards, showing more or less completely, as circumstances would permit, the highways of the country.

For co-operation with this central bureau, and the prosecution of the work in the most thorough and practical way, each State should have its highway commissioner, charged with the highest interests of the State in the way of maintaining its system of roads under the most approved methods and for the general public welfare. Then the best practical results could probably be attained by the division of the State into highway districts, consisting of counties, or perhaps townships, each of which should have its overseer, in full charge of the opening and construction of new roads in his district and the proper maintenance of all, responsible for the expenditure of the regular appropriations for these purposes. These districts could then be divided into smaller ones under sub-overseers.

The importance and the value to any country, any section, and every citizen from the highest to the lowest, whether tax-payers or tramps, of well-constructed and properly maintained roads, are not easily estimated, but clearly are greater than of many affairs which are continually receiving the time and attention of the people in their homes, counting-rooms, public meetings, and legislative halls. It is a matter to be considered side by side with our splendid and always improving system of public education, the assessment of our tariff duties, or the appropriations regularly made for river and harbor improvements.

R. A. PROCTOR MEMORIAL FUND.

THE English magazine *Knowledge* calls attention to the announcement in many of the London papers stating that the monetary affairs of the late Mr. Proctor have now been wound up by his administrator, and that the total sum available as provision for his widow and the seven children (four of whom are daughters, and one a little boy, a permanent invalid from hip-disease) is under £2,000. To the small income which this will produce there is to be added £100 per annum from the Civil List; which is, however, granted only during Mrs. Proctor's life.

The £2,000 above referred to as the value of the residue after the settlement of all debts, some of which were waived, has been produced by the sale of Mr. Proctor's copyrights. Mrs. Proctor and the eldest daughter have, under a satisfactory arrangement with Messrs. Longmans, retained a small interest in the works now in Messrs. Longmans' hands, including the "Old and New Astronomy," which will shortly be completed. But the value of the interest retained (calculated on the basis of the sum given for the remainder of these copyrights by Messrs. Longmans) is included in the £2,000, as is also the money received for all the other copyrights, which were purchased on liberal terms either by Messrs. Chatto & Windus or by Messrs. W. H. Allen & Co.

The money given immediately after the death of the late Mr. Proctor by the Royal Literary Fund, and the proceeds of five lectures given by Mr. W. Lant Carpenter, as well as gifts from other friends, have enabled the family, who, owing to the suddenness of Mr. Proctor's death, were absolutely without resources, to weather through the first year. But these funds have now been exhausted, and a committee is in course of formation which the many friends of Mr. Proctor are invited to join. Subscriptions to the R. A. Proctor Memorial Fund, and communications, will be received by Mr. E. G. Mullins, manager of the City Bank, Bond Street Branch, London, England.

Since the date of the announcement in the daily papers, the following subscriptions have been received: William James Adams, Esq., 10s. 6d.; "E. A.," £2; Mrs. Barrett, £2; "J. A. B.," £1; Andrew Chatto, Esq., £5; H. P. Curtiss, Esq., £5; W. Henry Domville, Esq., £10; "W. D.," £2 2s.; "A Friend," £1; Professor Grant, £2 2s.; Lord Grimthorpe, £20; D. Hodgson, Esq., £1; Edmund Johnson, Esq., £1 1s.; Messrs. Longmans, Green, & Co., £20; J. Mott Maidlow, Esq., £3 3s.; Miss Martin, £2; G. H. Mellor, Esq., 10s.; R. Hay Murray, Esq., £5; "Planetoids," 10s. 6d; T. Shaw Petty, Esq., £10 10s.; Oscar Rohde, Esq., £3 3s.; T. C. Sandars, Esq., £5; William Schooling, Esq., £2 2s.; F. Stevens, Esq., £1 1s.; Col. N. G. Sturt, £5; Mrs. Stowe, 5s.; Walter Weblyn, Esq., £1 1s.; Philip Williams, Esq., £1: total, £113 1s. Others have promised.

A NEW METHOD OF PREPARING FLUORINE.

A NEW method of preparing fluorine has been discovered by M. Moissan. This discovery is the outcome of the success which has attended M. Moissan's efforts to prepare anhydrous fluoride of platinum. During the process of his memorable work upon the isolation of fluorine by the electrolysis of hydrofluoric acid containing hydrogen potassium fluoride, one of the most remarkable phenomena noticed was the rapidity with which the platinum rod forming the positive electrode was corroded by the action of the liberated gaseous fluorine. It was surmised that a fluoride of platinum was the product of this action, but hitherto all efforts to isolate such a body have proved unsuccessful. In fact, for a reason which will be discussed subsequently, it is impossible to prepare platinum fluoride in the wet way. M. Moissan has, however, as stated in *Nature*, been enabled to prepare anhydrous platinum fluoride by the action of pure dry fluorine itself upon the metal. It was found at the outset, that, when fluorine is free from admixed vapor of hydrofluoric acid, it exerts no action whatever upon platinum, even when the latter is in a finely divided state, and heated to 100° C. But when the temperature of the metal is raised to between 500° and 600° C., combination readily occurs, with formation of tetrafluoride of platinum and a small quantity of protofluoride. The moment the gas is mixed with a little vapor of hydrofluoric acid, the action is immensely accelerated, and then occurs readily at ordinary temperatures. The same rapid action occurs when platinum is placed in hydrofluoric acid saturated with free fluorine, which accounts for the disappearance of the positive terminal during the electrolysis.

In order to prepare the fluoride of platinum, a bundle of wires of the metal is introduced into a thick platinum or fluor-spar tube, through which a current of fluorine gas from the electrolysis apparatus is passed. On heating the tube to low redness, the wires become rapidly converted to fluoride, when they are quickly transferred to a dry stoppered bottle. If the operation is performed in a platinum tube, a large quantity of fused fluoride remains in the tube. The tetrafluoride of platinum (PtF_4) formed upon the wires consists either of fused masses of a deep red color, or of small buff-colored crystals resembling anhydrous platinum chloride. It is exceedingly hygroscopic. With water it behaves in a most curious manner. With a small quantity of water it produces a fawn-colored solution, which almost immediately becomes warm, and decomposes with precipitation of hydrated platinic oxide and free hydrofluoric acid. If the quantity of water is greater and the temperature low, the fawn-colored solution may be preserved for a few minutes, at the expiration of which, or immediately on boiling the solution, the fluoride decomposes in the manner above indi-

cated. This peculiar behavior with water explains the impossibility of preparing the fluoride in the wet way.

When the anhydrous fluoride is heated to bright redness in a platinum tube closed at one end, fluorine at once begins to be evolved as gas; and, if a crystal of silicon be held at the mouth of the tube, it takes fire, and burns brilliantly in the gas. The residual platinum is found, on examining the contents of the tube, to consist of distinct crystals of the metal. Hence by far the most convenient method of preparing fluorine for lecture purposes is to form a considerable quantity of the fluoride, first, by passing the product of the electrolysis over bundles of platinum wire heated to low redness, and afterwards to heat the fluoride thus obtained to full redness in a platinum tube closed at one end. It only remains now to discover another method of preparing fluoride of platinum in the dry way, to be able to dispense with the expensive electrolysis apparatus altogether. M. Moissan has also prepared a fluoride of gold in the same manner. It is likewise very hygroscopic, decomposable by water, and yields gaseous fluorine on heating to redness.

MENTAL SCIENCE.

Diseases of the Memory.

CASES of amnesia, or the loss of a small or large portion of the contents of the mental storehouse, have been observed from very ancient times, and have always attracted attention. The decline of mental powers brought on by old age is frequently introduced by a failure of memory. When, however, this sets in at an earlier period, and develops rapidly and to an extreme degree, we recognize an abnormal and striking phenomenon. The possibility of such loss, particularly when following a purely physical cause, such as a blow, a fall, or other accident, could not but suggest the physiological counterpart of the memory process as something very material. To-day we attempt to analyze such cases more minutely, recognizing in the diseases of memory a natural experiment that throws light upon the laws of mental growth and decay, the interrelation of the various avenues of knowledge, as well as the *nexus* of mental function with anatomical characteristics. In all these aspects a recent study of diseases of memory by Dr. Korsakoff of Moscow (*Revue Philosophique*, November, 1889) is interesting.

The first case described is that of a Russian writer afflicted with multiple neuritis, — a nervous disease affecting many groups of fibres, as a consequence of alcoholic excess. When the patient was first seen, the trouble was very marked. He had completely forgotten all recent events: he did not even remember whether he had dined or not. The conversation just held was at once forgotten; and, when outsiders insisted that such and such things happened that the patient had forgotten, he lightly remarked that he always had a poor memory. Very striking is the fact that every thing previous to the onset of the disease he remembers clearly. Of a novel that he was writing at the time, and had half finished, he remembers the first half, but does not remember how he intended to finish it. Though the domain of his thoughts is limited, his reasonings are logical, and his judgment sound. But a slight interruption in the conversation will make him forget what it was about; and he will say the same things over and over again, using the same stereotyped forms of expression, and forgetting that he has said it. Moreover, under the influence of certain external stimuli, certain positions and suggestions, he will always make the same remarks, in which he draws upon the old storehouse without adding to it. There are indications, too, that to a slight degree the unconscious registration of impressions is going on. Thus, though he forgets Dr. Korsakoff between each visit, he always makes the remark (regarding it as original each time) that the latter is a physician. Emotions and feelings make more of an impression than facts and associations. A *post-mortem* examination in this case showed degeneration of both fibres and cells, which had also been inferred from paralysis and other symptoms observed in the patient.

Impairment of memory is characteristic of this disease; the memory for recent events being lost, while that for events antedating the attack remains, and the patient retains judgment and reasoning power. The same patient who forgets that he has dined five minutes after leaving the table can play cards or checkers with fair skill, anticipating the consequences of his or his adversary's plays, and following out a plan of attack or defence. If the game is slightly disturbed, he cannot go on. The moment he is through playing, he knows nothing of it, and will declare he has not played for a long time. The contrast between the past and the present is sharply brought out in one patient who tells of his travels at great length, but repeats the tale a dozen times an hour, and always with the same phrases. Sometimes the patient does not even recall that he is ill, explaining a paralysis as a momentary cramp in the legs, and expressing his intention of rising as soon as that has passed. The same patient will cry out under his pain, but a moment later will have forgotten the sound and the pain. To show how slight an interval is needed for the impression to disappear, it may be mentioned that this patient, in reading, will read the same line twice, having forgotten the one line before setting out upon the next. Those who are constantly with such patients soon get to know what they will say upon the usual occasions. Their life is monotonous, — a response to the suggestions from the outside, and not originating from internal impulses. They are frequently conscious of their infirmity, and anxious lest they commit some indiscretion.

Dr. Korsakoff thinks, that while the patient does not consciously remember what is going on, yet the surrounding events leave some trace by which future conduct is influenced. Thus a patient who was undergoing an electric treatment, and forgot all about it each time, not being able to tell what the doctor was about to do, if asked to look about him, recognized the apparatus and its purpose, which he did not know before his illness. Another patient, who said "Good-morning!" when the doctor made his first visit of the day, did not remember the visit three minutes later, but did not then say "Good-morning!" The most convincing proof of this, however, appears when recovery sets in, and the patient begins to tell some little of what happened during his illness. In one case a sphygmograph was described, — an instrument the patient had seen only during his amnesic period. Emotional states seem the ones most susceptible of this unconscious perception. While the patient forgets his visitors from one time to another, yet he meets them with sympathy or antipathy, according to previous experiences; or, again, a patient who was treated with electricity remembered nothing of it, but was always put into a bad humor when he saw the machine.

In the process of recovery, usually quite gradual, several interesting phenomena appear. Frequently the patient begins to remember events, but in isolation. He cannot tell what happened just before or just after. He cannot tell *when* things happened; as a rule, regarding all things as more recent than they really are. When he begins to remember new faces and places, he still continues to repeat the same sayings again and again. He will be able to say that he has read a certain thing, but does not remember what it contained. Though not able to recall the events of his illness at will, an incident or a suggestion may bring it up. Little by little his past is filled out, though in a somewhat chaotic manner; dreams and the products of his imagination intermingling with real events without definite relation in time. He frequently continues to believe what has no basis in fact. His recovery is often a matter of two or three years. In another case, after five years the memory of the patient continued weak. He was able to resume his occupation of correcting sheets for the press, but had to keep his finger on the lines so as not to go over the same line twice. He even began to practise law, though he was compelled to avail himself of all sorts of memoranda, and was frequently perplexed by forgetting what he had said; yet he was able to conduct himself consistently. The memory for places, streets, and houses, localities in general, is restored long before that for time.

Dr. Korsakoff next attempts to analyze just what factor in memory is affected, concluding that it is simply the power to recall impressions; the facts above cited showing that the impression is made, though very faintly. Moreover, as recollection is based upon association, those ideas being most at command that have the widest and deepest associative connections, the defect is referred to that portion of the nervous system instrumental in connecting nerve-centres with one another. Into a more detailed and neces-

sarily hypothetical explanation of the relation between memory and nerve-cell, we need not enter. The main result connects the easiness of forgetting recent impressions with instability of nerve-cell, and isolation from the cell groups; while the older, more deeply impressed and integrated experiences remain.

A corroboration of this result is found in the fact that in the recovery there is a stage in which the patient remembers that a thing happened, but not where or how; not even, perhaps, whether it was dreamed, or really experienced. The associations that localize the event are not made, although the impression made by the event is there. Only in the final stages of recovery are the associations and the facts remembered.

NOTES AND NEWS.

A STALACTITE cave has been discovered in Ascheloh, near Halle, in Westphalia. It is reported to be more than 100 metres long.

— A series of questions on the effect of London fogs on cultivated plants has been issued by the scientific committee of the Royal Horticultural Society. The experience of the current season only is to be utilized.

— A hippopotamus was born in the Central Park menagerie, this city, on the night of Dec. 1; and this is said to be the first instance of an event of this kind in this country. Unfortunately it died on the 6th of pneumonia, as we learn from the *Boston Medical and Surgical Journal.*

— The Gilbert Club, to which we referred last week, was formally founded on Thursday, Nov. 28. The following officers were appointed at the first general meeting: president, Sir William Thomson; vice-presidents: Lord Rayleigh, Professor D. E. Hughes, Professor Reinold, Mr. Jonathan Hutchinson (president of the Royal College of Surgeons), Dr. B. W. Richardson, and Mr. H. Laver of Colchester. Mr. Latimer Clark was elected treasurer; and Mr. Conrad Cooke, Professor R. Meldola, and Professor S. P. Thompson, honorary secretaries. The resolution finally adopted by the meeting was, according to *Nature*, "That the objects of the Gilbert Club be as follows: (1) to produce and issue an English translation of 'De Magnete' in the manner of the folio edition of 1600; (2) to arrange hereafter for the tercentenary celebration of the publication of 'De Magnete' in the year 1900; (3) to promote inquiries into the personal history, life, works, and writings of Dr. Gilbert; (4) to have power, after the completion of the English edition of 'De Magnete,' to undertake the reproduction of other early works on electricity and magnetism, provided at such date a majority of the members of the club so desire." At the time of the inaugural meeting eighty-seven members had joined the club.

— The chief signal officer has adopted a signal known as the "information signal," and forming one of the system of "storm, cautionary, and wind-direction signals." The "information signal" consists of a yellow pennant, of the same dimensions as the red and the white pennants (wind-direction signals), and, when displayed, indicates that the local observer has received information from the central office of a storm covering a limited area, dangerous only for vessels about to sail to certain ports. The signal will serve as a notification to ship-masters that the necessary information will be given them upon application to the local observer. The use of this signal began Dec. 1. It is believed that the display of the "information signal" will in many instances obviate the necessity for the display of the "cautionary signal" (yellow flag with white centre). The signal at night for indicating westerly winds is now a white light above a red light.

— Lieut.-Commander Charles H. Stockton, U.S.N., commanding the United States steamship "Thetis," reports to the United States Hydrographic Office that during the past summer, while on the north and north-west coasts of Alaska, the "Thetis" set adrift numerous drift floats. These floats are made of wood, about 2 feet long and 9½ inches thick, with the name of the ship, date, and the words "for drift," cut upon the face. In a cavity at one end of the float, plugged with soft wood, there is a copper cylinder containing a letter requesting the finder to inform the Hydrographic Office, Washington, D.C., the nearest United States consul, or the commanding officer of the "Thetis," the time and place where the float was found. These floats are intended to show the direction and strength of the currents off the coast of Alaska, and any information obtained from them will be of value to navigation. Masters of vessels in Alaskan waters, or residents on the coast of Alaska, finding any of these floats, are especially requested to comply with the request contained in each copper cylinder.

— A course of public lectures was begun before the New York Academy of Sciences, Madison Avenue and 49th Street, on Monday evening, Dec. 2, at eight o'clock, to continue until May 19, 1890. The following is a list of the lecturers, together with the subjects and dates of the lectures: Dec. 2, "The Raiyan-Mœris: the Irrigation of Ancient and Modern Egypt" (illustrated by the lantern), by Mr. F. Cope Whitehouse of New York; Dec. 16, "Strategic Features of the Gulf of Mexico and the Caribbean Sea" (illustrated by maps), by Capt. A. T. Mahan, U.S.A.; Jan. 20, 1890, "The Ice Age in North America, and the Antiquity of Man" (illustrated by the lantern), by Professor G. Frederick Wright, Oberlin College, Ohio; Feb. 17, "Four Weeks in the Desert of Mount Sinai" (illustrated by the lantern), by Dr. H. Carrington Bolton of New York; March 17, "Nebulæ and the Nebular Hypothesis" (illustrated by the lantern), by Professor Charles A. Young, Princeton, N.J.; March 31, "Volts and Ampères, and What they mean" (to be held in the chemical lecture-room, School of Mines; illustrated by electrical apparatus and experiments), by Professor Charles F. Chandler, Columbia College; April 14, "Methods of Research in Bacteriology" (illustrated by photo-micrographs of bacteria), by Major George M. Sternberg, M.D.; April 28, "Glimpses of the Arctic Regions" (illustrated by the lantern), by Mr. William Bradford of New York; May 19, "Grand Cañon of the Colorado" (illustrated by the lantern), by Professor Rossiter W. Raymond of Brooklyn.

— The question of a system of improved public roads, to which we refer elsewhere, is one so closely related to every material interest of the State as to place it properly among the most important questions of public economy. The science of road making and maintaining, though neither difficult nor abstruse, is nevertheless based on principles so well established, and so unvarying in their operation, as to render their thorough comprehension an essential to success in securing and maintaining public roads at once efficient and economical, whatever the administrative system by which they are constructed and controlled. In other countries the superintendence of public highways is recognized as an important and responsible duty, and is usually assigned to specially trained, expert government engineers; while in the United States, where the greater mileage makes the economy, if not the efficiency, of roads even more important than abroad, the States depend for this responsible service on private citizens, locally and temporarily appointed to the duty, without providing for them the technical instruction and training so essential to success under any system. To offer such as desire it an opportunity to make good, in part, this defect, the Engineering Department of Vanderbilt University, Nashville, Tenn., continues its offer of former years to admit free of charge, to a class in road engineering, one principal or deputy highway official from each county in Tennessee. The appointment shall be made by the chairman of the county court, on or before Jan. 1, 1890, and must set forth that the candidate is in a position to be of benefit to the public road-system of the county wherein he resides. If in a county no applicant apply for appointment before Jan. 1, the chairman of the county court shall, until Feb. 1, 1890, have the privilege of appointing one similarly qualified applicant from any other county of any State. The course of instruction will extend from Feb. 1 till April 1, and will consist of lectures and work on the economical location of highways to conform to conditions of topography and traffic; principles of construction of new and reconstruction of old roads, and of maintenance *vs.* repairs; methods of drainage; simple highway structures, retaining walls, drains, culverts, simple bridges; practice in field-sketching, simple platting and draughting, instrumental location, and computing estimates of cost; and study of systems of highway administration.

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Attention is called to the "Wants" column. All are invited to use it in soliciting information or seeking new positions. The name and address of applicants should be given in full, so that answers will go direct to them. The "Exchange" column is likewise open.

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ONE OF THE DISADVANTAGES of a popular form of government and of thorough democracy, recognizing absolute equality of all citizens, whether rich or poor, wise or stupid, familiar with business or ignorant of all its forms, is illustrated by the fact that the current technical journals are describing an ironclad "designed" by a distinguished lawyer, who happens to be a member of Congress and of the Naval Committee of the House of Representatives. It would seem that this distinguished lawyer has thought himself, and has been thought by his colleagues, competent to plan what, in its highest form, is the very culmination of scientific knowledge, of engineering talent, and of the mechanic's inventive power. In other countries it is supposed, both popularly and by the officials of governments, that such a construction could only be safely attempted when the designs have been prepared by engineers and naval architects of the most exceptional experience, and who have shown by their works that they possess those combinations of talents (vastly more rare than those of the successful general) which are essential, as has been supposed, to highest perfection of construction. It would sooner be proposed, in any other country than the United States, to intrust the life of a sick man to the care of an uneducated laborer of the docks rather than to that of an educated physician, as to place in the hands of a non-professional the planning of structures which are expected to cost millions of dollars, to illustrate the grandest results of modern engineering, and protect the interests and the honor of a great nation.

The story, if told abroad, will undoubtedly be received with absolute incredulity, as one of those incomprehensible American "jokes" which the average European mind can never hope fully to appreciate; but, were it believed, the average American can probably as little conceive the astonishment that it is likely to awaken. The conceit of the lawyer, turned engineer and naval architect, who could imagine himself fitted for performing the work of a member of another profession; the social, and especially the official, customs that could make such a thing possible; the quietness with which the proper departments and officials could thus permit themselves to be set aside while an amateur undertakes their work; the even more extraordinary attitude of the committees of Congress, of Congress itself, in looking on with indifference while this curious and remarkable phenomenon is being exhibited, and actually, as is reported, voting the million dollars and a half required for the still more remarkable experiment in the inversion of the commonly accepted principles of business, — would appear, then, about equally extraordinary and incredible. In fact, it would seem quite as incredible to some of our own citizens, were it not for the fact that the name of the distinguished amateur is given, and the details of his proposed construction are presented in full.

Our only explanation of this singular incident seems to be suggested by the extent to which details are given in the specifications published, which indicate, that behind the great lawyer, and hidden by his grander proportions, is somewhere a naval architect who is too modest, or who, for some more inscrutable reason, either does not care or does not dare come into view as the responsible designer of this expensive toy. Could it be possible that the whole performance represents the catering of a bureau of the Navy Department to the political friend relied upon to promote its interests or those of its officials in Congress? If this be the case (and we would not like to believe it, suggestive as the circumstances are of such an explanation), the danger to the interests of the government and of the people; the injury to the reputation of the constructive bureaus of the Navy Department and to that of the secretary of the navy; the compromising of the unquestionably able and distinguished lawyer who is the victim of this scheme, and who must appear before the world, at home and abroad, as enormously conceited and equally unwise, — should promptly lead to the revelation, by the officials concerned, of the real state of the case. The people of the United States cannot afford to hand over a million dollars and a half to an amateur, or to risk its success in battle, and its honor on the sea, in any such wild experiment; much less can it afford to place in official position men who have so little knowledge of the first principles of ordinary business.

THE CONTOURED MAP OF MASSACHUSETTS.

FIVE years ago the United States Geological Survey and the Commonwealth of Massachusetts entered into an agreement concerning a topographic survey of the State, the results of which are now gradually coming before the public. The field-work was completed two years ago. A number of the inch-to-a-mile, contoured, quarter-degree sheets have been engraved, and proofs have been struck off for use in the survey. It is to be hoped that they may all be soon published by the State, and placed on sale at the cost of printing. New Jersey has reached this desirable stage, and its invaluable atlas of twenty sheets can now be bought for twenty-five cents apiece, or five dollars for the entire set.

The map of Massachusetts here referred to more particularly is in four sheets on a reduced scale of about four miles to an inch (1: 250,000), with contours every hundred feet. The irregular shape of the State gives the map an unsatisfactory form, that will be

remedied when Connecticut and Rhode Island are added to it, as they may be in a few years; the field-work being completed for Rhode Island, and well under way for Connecticut. The water is printed in blue; the contours, in brown; the names, boundaries, railroads, and meridians and parallels, in black. The map is a handsome piece of work, but it is questionable if a finer effect could not have been produced by using a dark gray to indicate the cultural work; for the black is in too great a contrast with the rest to give satisfaction to the eye.

The larger physical features of the State are brought out with much clearness. The gradual ascent inland from the coastal lowland to the uplands can be traced quantitatively now for the first time on a map. The upland surface is, to be sure, greatly broken by valleys, but the general accordance of summit altitudes and their progressive increase westward are so well marked that they are best interpreted as remnants of an old lowland, nearly plain, — a "peneplain," as it might have been called, — now moderately elevated and inclined eastward, and much worn by subsequent valley-cutting. Very few hills rise distinctly above the surface of the old peneplain; Blue Hills near Boston, Wachusett between Worcester and Fitchburg, and Greylock in the north-western corner of the State, being the most conspicuous examples of such forms. The mountains of Berkshire are generally but little higher than the expanded surface of the plateau next eastward, and have gained their present bold relief by the wasting-away of the limestone valley floor. In the same way the trap ridge of Mount Tom and the conglomerate mass of Mount Toby stand above the floor of the deep and broad Connecticut valley that has been excavated by this ancient river in the soft triassic shales.

The contrast of form between upland and valley gives corresponding contrast in the villages built at high and low levels. Hubbardston, Petersham, and Royalston on the central plateau, east of the Connecticut valley, stand just above the contour line of 1,000 feet. Blandford, Worthington Corners, and Heath, on the western plateau, are over 1,500 feet. The hills rise little above the open country far and wide around these airy settlements, but the valleys are sunk deep below them. All the larger villages, and most of the factories of the plateau region are in the valleys; but the shoe-shops climb to high levels in Spencer and North Brookfield. The railroads follow the valleys as far as possible, and have no high bridges; this being characteristic of railroad construction on an upland so far consumed by river-work. In western Pennsylvania and New York, where the upland is more continuous and the valleys correspondingly narrower, many railroads run on the high ground, and then have to cross the river-trenches in lofty viaducts.

The wide valleys of Berkshire and the Connecticut River, opened on weak rocks, are cultivated in broad, smooth fields. The narrow transverse valleys of the adjacent plateaus, cut across the hard rocks, have steep rocky slopes and mere strips of gravelly bottomland. The Deerfield, Westfield, Miller's and Quaboag Rivers show these features most distinctly, as any traveller on the Fitchburg or Albany Railroad may observe. The western plateau is drained in a curious fashion by streams that rise close to its western margin at heights above 2,000 feet, and traverse its entire breadth in direct or oblique courses to the Connecticut valley. Its western slope into the Berkshire valley is very abrupt. This suggests that the Berkshire limestones were not so widely exposed on the surface of the old peneplain as they are now; and that then there was no master-stream upon them, such as the Housatonic now is. If this be correct, we must picture the drainage of the old peneplain-lowland as flowing eastward from the western border of the State to the Connecticut valley, and must regard the Housatonic as a capturing stream that grew northward by head-water gnawing, after the old lowland was raised to something like its present height. The short steep ravine streams that now drain the western slope of the plateau follow inverted courses to the Housatonic; and the divides that separate them from the Connecticut tributaries must be unstable, and slowly migrating to the eastward. A walk along the margin of the plateau, past the heads of these ravine-streams, ought to detect the characteristic consequences of such migration in the form of the lateral secondary valley, that have been recently diverted from eastward to westward outlet; but the presence of drift in this region may complicate matters so far as to render such analysis impossible.

The presence of ponds and lakes is the most perceptible consequence of glaciation. The eastern part of the State is perceptibly blued over by them, but on the higher uplands they are relatively rare.

The separate quarter-degree sheets of larger scale, about fifty of which will be required to cover the State, will receive special notice when they are completed and published. W. M. D.

BOOK-REVIEWS.

Aspects of the Earth: A Popular Account of Some Familiar Geological Phenomena. By N. S. SHALER. New York, Scribner. 8°. $4.

THIS is a superb reproduction in book form of the excellent papers by Professor Shaler, that recently appeared in *Scribner's Magazine*. There are sixteen full-page illustrations, besides nearly a hundred in the text, the most of them copies of photographs in the finest and most faithful style of wood-engraving. These transcripts from nature the author believes to be more helpful to the general reader than diagrams that require a schooled eye to apprehend.

The topics of the chapters are "The Stability of the Earth," "Volcanoes," "Caverns and Cavern Life," "Rivers and Valleys," "The Instability of the Atmosphere," "Forests of North America," and "The Origin and Nature of Soils." It is a good selection of themes that at once possess a scientific interest and a popular and practical bearing; all, in fact, relating to the surface of the earth or to phenomena more or less familiar to the public. The author has made it his special purpose, in his own words, to choose subjects that "commend themselves to the attention of intelligent people," and "show the relation of natural forces to the fortunes of man."

The first chapter offers a satisfactory explanation in general of earthquakes, though not emphasizing and illustrating the effect of cumulative tension in the earth's crust, which might be compared to that which is indicated by the cracking sounds of a stove-pipe under the expansion of heat, or of a house under the contraction of extreme cold. There is a full treatment of the facts in regard to earthquake regions in the United States, especially as connected with undisturbed pinnacles of rock and poised bowlders as indices of long periods of rest. These may be admitted as proofs of the absence of great earthquakes, but are hardly to be regarded otherwise, inasmuch as a pinnacle, a wedged bowlder, or a "rocking stone" might endure a good deal of oscillation.

Volcanoes are referred to the superheating of water everywhere permeating the crust to the amount of twenty per cent or more, — a simple solution that is a relief to one's mind after all the theories about descending sea-water, lakes of fire, and what not. Caverns and cavern life, rivers and valleys, are treated with the freshness of statement and illustration that characterize the entire volume; and while a theoretic item still under discussion is sometimes assumed as fact, there is, for example, a candid remark that cave-life exhibits modifications that cannot be caused by the competitive struggle of existence, — an impartial remark in the noble spirit of Darwin himself. The natural bridges, as that of Virginia, are explained as remains of caverns. The cañons of the West are well accounted for, and the cutting of rivers across mountains, also, but in a way that would have been helped by the very apt illustration (in a United States geological report) of a saw-log slowly rising against a horizontal saw.

The advocates of forest conservation have an ally in Professor Shaler, who clearly sets forth the evils of denudation. It would appear, however, that the destructive process goes on mostly in wild districts, and that long settlement of a district tends to restore, and even to create groves where they were not. This last tendency is strikingly manifest on the prairies in a few years after occupation, and a manifestly changed climate follows. The loss of a rich top-soil by washing, after the plough has broken up the original protecting turf, is an evil that needs more attention. Is it not possible to check this in a measure by so running the furrows that these shall not be channels of waste, and to further avoid this

result by back-ploughing every alternate furrow, making it a dam. Surely the practice, recommended by some, of subdividing the rainfall by furrows running up and down a slope, must be more wasteful in the final result than an occasional rushing break of the water retained by the process above described.

Cyclones and tornadoes are amply discussed in the light of the latest investigations. A diagram of equatorial and polar currents would aid such readers as are not familiar with the general theory of winds; and there seems to be in this book an over-valuation of winds in the production of the great ocean-currents. In regard to tornadoes, observation would teach that the author's advice to construct houses of brick or stone in tornado regions is not wise. A massive stone building is torn to pieces as easily as one of wood, and with far more danger to the occupant. In fact, the stone foundations of a house are sometimes swept clean off, level with the ground. In the path of the tornado there is but one security, — an outside underground refuge with most direct access from the living-rooms of the house, such as by a trap-door and stairs, if the ordinary cellar stairway is not near the south-west corner. The roar of the storm may readily be mistaken for that of cars. The funnel of the cloud may follow at some interval the accompanying general storm, when one least expects devastation. There may not be a moment to lose in going to an out-of-doors tornado-refuge, which some have recommended. And there should be not only ingress from the cellar, but some mode of egress from the cave in case the cellar entrance is blocked by *débris*, and especially in case the wrecked house takes fire. Certainly, in exposed regions, fifteen dollars spent in rightly providing a refuge is worth the peace of mind it brings, though the terrible disaster never comes.

The concluding chapter on soils is of interest to every intelligent reader as well as to cultivators of the ground. Happily, it must have come into many rural homes in its first form as a magazine article. Of course, the great expense of this volume is its engravings, such a full-page picture as that of the Yellowstone Falls probably costing two hundred dollars. But, many of the woodcuts having already paid something like their cost in the magazine, it is to be regretted that a cheaper edition on less costly paper is not issued along with this luxurious one; lighter, too, for the very heavy paper in a book of this size is a considerable weight to hold, in this instance three and a half pounds. Large type and very thick paper are suitable in books of a pictorial sort for brief entertainment rather than continuous reading.

"Evolution of Sound" Evolved. By M. J. THOMPSON. Cincinnati, Standard Publishing Co. 8°.

THERE once lived in this town (by "this town" we mean New York) a certain Dr. Hall, who was much given to violent attacks on all that had been considered as reasonable by ordinary mortals in the results of the investigations of scientific men. It may be that some of our readers will remember the doctor's attack on the wave-theory of sound, and his vehement appeals to scientific men to answer his arguments against the validity of the conception we now have of the way in which sound is propagated. It cannot be said that opportunity for discussion was lacking, for the warlike doctor even went so far as to establish a journal — *The Scientific Arena* — for the very purpose of furnishing a suitable medium for open discussion of the merits of his arguments. But all this was to little purpose till the author of "'Evolution of Sound' evolved," at that time professor of science in Garfield University, Wichita, Kan., published a number of letters, pointing out how the doctor had wandered a little from the paths of wisdom. These have been collected in book form; and, even if they did not serve the purpose of opening the eyes or ears of Dr. Hall, it may happen that there will be others who will find in them answers to attractive sophistry or to their own doubts.

Appended to these letters is reprinted Professor Thompson's graduation thesis at Ann Arbor, on the measurement of chemical affinity.

Mountaineering in Colorado: the Peaks about Estes Peak. By FREDERICK H. CHAPIN. Boston, Appalachian Mountain Club. 12°.

THE Appalachian Mountain Club is made up of those men and women, boys and girls, who, for the most part living not far from Boston, delight in taking walks. The most of their excursions are, per force of circumstances, taken through the most attractive regions to be found near their homes. But every year one or more parties start for a tramp through the White Mountains, a winter tramp in that region being a yearly feature of the club's doings. All this leads to an increase in the intelligent interest in the hills and mountains visited, and is very pleasant as a recreation for those able to take part.

The volume now before us shows that one member has had the temerity to venture thousands of miles from the usual haunts of his colleagues. We have in it a record of his wanderings through unfrequented valleys, and even those hitherto unvisited by white men, of his clamberings over peaks, and of the views he saw. Fortunately our author was an admirable photographer, and fortunately again his negatives fell into the hands of good engravers, as we are enabled, by the excellent and numerous pictures with which the volume is embellished, to gain some idea of what was spread before his eyes.

The book is well written, contains a good deal of information such as is told in the narratives of travellers, and is a real contribution to our knowledge of one of the few out-of-the-way and yet wild corners of our country.

The Graphic System of Object Drawing. By HOBART B. JACOBS AND AUGUSTA L. BROWER. New York, A. Lovell & Co. 75 cents.

THE aim of the authors of this admirable series of drawing-books is to give the pupil a clear idea of form, to help him to express that idea on paper, and to give him command of his pencil, so that he can draw the objects about him. The plan of the work is so simple that any teacher can use it; and a manual for the teacher's use, which accompanies the set of drawing-books, makes the system plain even to those entirely unskilled in the art. The course is intended to cover four years of practice, and is adapted for use in both public and private schools. The part of the series intended for the primary course deals only with single objects in outline; the part for the intermediate course is devoted to drawing from groups of objects; in the part prepared for the grammar department, studies in tones and values are given; and for the high school, thorough instruction in drawing from life is found. Manuals for the four departments, or four-years' courses, are provided.

While the methods for work given in this series are based on the systems current in many of the best schools of art, and on the practice of the most successful art teachers, no attempt is made to attain the critical accuracy to be expected in more advanced text-books. The authors claim for it simply an original and highly efficient arrangement of lessons; and no one who carefully examines the system will deny that it is one which will naturally call forth the interest and develop the powers of the pupil.

AMONG THE PUBLISHERS.

A HISTORY of American literature, by Karl Knortz of this city, will be published shortly in Berlin by Hans Lüstenöder.

— John P. Morton & Co., Louisville, Ky., have in preparation a work on "Kentucky Jurisprudence," by Lewis N. Dembitz of the Louisville bar.

— The American Writing Machine Company, Hartford, Conn., has issued a pamphlet showing a selection of writing-papers suitable for use on the Caligraph.

— "Odds and Ends from a Literary Junk Shop" is the title of a priced catalogue of new and second-hand books just issued by A. S. Clark, 34 Park Row, this city. It contains many points of interest to book-buyers.

— Thoroughly earnest work is being done in behalf of tariff reform by the New York *Weekly Post*, which holds that the time to discuss this economic question is now rather than in the heat of a presidential campaign. Every issue of the paper contains articles bearing upon some phase of the subject, together with questions by doubting readers, with answers by the editor, all tending to facilitate and simplify the discussion. The *Post* is compiling a di-

rectory of active tariff-reform organizations in the United States, and has already published one instalment of the list.

— Travellers on the Nile will be glad to learn that the second volume of Baedeker's "Guide-Book to Egypt" is at last about to appear. It will be devoted, says *The Publishers' Weekly*, to a description of upper Egypt, and has been compiled by the well-known Egyptologist, Professor Eisenlohr.

— Charles L. Webster & Co. publish this week Mark Twain's new book, "A Connecticut Yankee at King Arthur's Court," which satirizes the shams, the laws, and customs of to-day under pretence of dealing with the England of the sixth century. It is fully illustrated by Daniel Beard.

— The Bancroft-Whitney Company, San Francisco, Cal., have just issued the first two volumes of Lawson's "Rights, Remedies, and Practice." The work, which is to be complete in seven volumes, issued at the rate of one a month, does not deal in theories, but is written for the every-day use of the profession.

— Houghton, Mifflin, & Co. announce "The Bible and Modern Discoveries," by Rev. Henry A. Harper, connected with the Palestine Exploration Fund. He has written other books of much interest on Palestine, but the peculiar feature of this book is that it connects the remarkable discoveries made in the Holy Land with the Bible narrative.

— B. F. Stevens, according to the London *Athenæum*, has just produced the first volume of his magnificent collection of facsimiles of documents in European archives relating to the United States. The second volume will be ready this month, and two more will be in the hands of the subscribers early next year. The total number of copies printed is limited to two hundred.

— The J. G. Cupples Publishing Co. have in press a work by Nathaniel Pitt Langford, of St. Paul, entitled "Vigilante Days and Ways; or, The Pioneers of the Rockies, being Sidelights on the Makers and Making of Montana, Idaho, Oregon, Washington, and Wyoming." It will be published in two volumes, and will be illustrated.

— The first number of *College and School*, a monthly magazine for teachers, students, and parents, has made its appearance; Utica, N.Y., being the place of publication. It is bright and attractive in appearance, presents a good table of contents, and we trust will be a success, although its field of work is pretty well coveerd already.

— A book entitled "Thought and Thrift," written by Joshua Hill, a farmer in Kentucky, is announced as in the press of Raisbeck & Co., No. 19 West 6th Street, Cincinnati. It will be a discussion of political and economic questions from the point of view of a practical agriculturist, which it is said will be of great value and interest to the agricultural classes as well as to those interested in the subject from the economic and political side.

— In *The Writer* (Boston) for December, following a personal sketch of Mrs. George Archibald, are articles entitled "Duplicating Manuscripts," "The Opening Sentence," "The Husbands of Literary Women," "'Don'ts' for Young Writers," "Needless Words," "A Reader's Appeal to Writers," and "Blocking Out Poetry." A new department is entitled "The Use and Misuse of Words." In it every-day questions of language are discussed briefly. The department "Helpful Hints and Suggestions" this month is devoted mainly to plans for preserving clippings, and many novel ideas are suggested.

— *The Chautauquan* for January contains the following articles: "The Railroads and the State," by Franklin H. Giddings; "A Miniature Glacier," by Professor N. S. Shaler; "Too Much Theorizing," by John Habberton; "A Striking Feature of the Age," by Professor A. S. Hardy; "Great Britain's Ministry," by J. Ranken Towse; "James Anthony Froude," by Professor W. M. Baskervill; "Sam Houston's Marriage," by Coleman E. Bishop; "The Negroes of Trinidad," by Victor Smith; "Some Ohio Gypsies," by James K. Reeve; and "What England has done for India," by Bishop John F. Hurst.

— The fourth volume of Baron Haussman's memoirs, which is shortly to be published in Paris, will describe in detail the inner life of the Second Empire. Among many other matters, according to *The Publishers' Weekly*, the narrative promises to throw a new light on the discussions with Prince Bismarck, at Biarritz and elsewhere, as to the conclusion of an alliance between France and Prussia, and the formation of a German Empire at the expense of Austria. There will also be some unrevealed particulars in connection with the negotiations for peace after the war of 1870, affording much information about the part which Napoleon III. took in them.

— D. Appleton & Co. announce as ready this month "Exercises in Wood-Working: A Text-Book for Manual Training Classes in Schools and Colleges," by Ivin Sickles, M.S., M.D. This book consists of two parts. The first, a treatise on wood, includes the growth, structure, properties, and kinds, cause of decay, destructive insects, and means of preserving wood. The second part contains a description of tools, methods in drawing used to illustrate the exercises, and methods of sharpening tools. These are followed by thirty-nine progressive exercises, arranged as follows: 1. Practice with the ordinary wood-working tools; 2. Construction of simple joints; 3. Construction of complex objects; 4. Elements of house-carpentry; 5. Directions for finishing work. The exercises are illustrated by full-page plates, and are accompanied by numerous applications. Directions for each exercise are printed on the page opposite its diagrams, and particular attention has been paid to marking or laying out the work preparatory to cutting.

— Messrs. Funk & Wagnalls (New York) announce a new biographical series, "American Reformers," edited by Carlos Martyn, D.D., — a man of whom Wendell Phillips said, "If I were looking for a biographer, I would lay hands on Mr. Martyn. His arrangement is unique and effective. His grasp is both wide and strong. His historical scent is keen as that of an Indian on a trail." There are to be twelve volumes in the series, to be published one each two months, beginning in January, to be issued in uniform size and style (12mo, of about 300 pages each, in cloth) at $1.25 per volume, Here are the subjects and the writers: "Wendell Phillips, the Agitator," by Carlos Martyn, D.D.; "Horace Greeley, the Editor," by Francis Nicoll Zabriskie, D.D.; "Horace Mann, the Educator," by Hon. Frank B. Sanborn; "William E. Dodge, the Christian Merchant," by Carlos Martyn, D.D.; "Abraham Lincoln, the Emancipator," by Professor C. W. French; "Frederick Douglass, the Colored Orator," by Frederic May Holland; "John G. Whittier, the Poet of Freedom," by Sloane Kennedy; "William Lloyd Garrison, the Abolitionist," by Hon. George W. Williams, LL.D; "John B. Gough, the Apostle of Cold Water," by Carlos Martyn; "Charles Sumner, the Scholar in Politics;" and "Henry Ward Beecher, the Pulpit Orator."

— We have received the first and second numbers of "Haverford College Studies," published by the college faculty. They are all either historical or mathematico-astronomical. No. 1 opens with an article on "The Library of the Convent of the Holy Sepulchre at Jerusalem," by J. Rendel Harris, giving an account of the formation of the library by the union of three smaller ones, with notes on some of its treasures. Then follow a series of "Micrometrical Measurements of Double Stars," and other observations made at the college observatory. They are quite elaborate and extensive, filling nearly sixty pages of the pamphlet. There is another astronomical paper, "On the Period of Rotation of the Sun," by Henry Crew, who gives as the result of his observations the period of 26.23 days. Frank Morley has a paper, "On the Geometry of a Nodal Circular Cubic," which has been published before in the *American Journal of Mathematics;* and the number closes with an elaborate essay by Francis B. Gummere, "On the Symbolic Use of the Colors Black and White in Germanic Tradition." This last paper is perhaps the most interesting in the collection, and contains much curious lore. Pamphlet No. 2 consists mainly of an essay on "The Rest of the Words of Baruch," by J. R. Harris, with several pages of the Greek original; and this is followed by facsimiles of "Two Esarhaddon Texts," by R. W. Rogers, from the originals in the British Museum. On the whole, these studies are more elaborate than most publications of American colleges, and represent a great deal of work.

— Henry C. Frink (234 Broadway, New York) announces a calendar for 1890 ("Perles de la Littérature Française"), with one quotation each from 365 different French authors; also a calendar for 1890 ("Perlen der Deutschen Litteratur"), with one quotation for every day in the year, selected from eminent German authors. The above calendars are engraved and hand-painted. The quotations are selected by A. N. Van Daell, professor of modern languages in the Massachusetts Institute of Technology.

— Mr. Clarence M. Weed, M.Sc., has published, in a recent bulletin of the Illinois State Laboratory of Natural History, an article entitled "A Partial Bibliography of the Phalangiinæ of North America." In it he states that he has included most of the references to this group in our American literature, and mentions the genus of several species of *Phalangium* of which he has seen no specimens, but which probably do not belong to that genus as now restricted. He has also published in the same bulletin an article entitled "A Descriptive Catalogue of the Phalangiinæ of Illinois." The great majority of the American species of those familiar creatures commonly known as "harvest-men," or "daddy-long-legs," belong to the subfamily *Phalangiinæ* of the family *Phalangidæ* of the sub-order *Opilonea* and order *Arthrogastra*. Though abundant and widely distributed, these arachnids have as yet received comparatively little attention in this country. The laboratory collections on which this article is based have largely been made within the last two years.

— The following is the title of a book just published by the C. R. Barns Publishing Company, St. Louis, Mo.: "New Light from Old Eclipses; or, Chronology corrected and the Four Gospels harmonized by the Rectification of Errors in the Received Astronomical Tables," by William M. Page, with an introduction by Rev. James H. Brookes, D.D. The book is illustrated by several striking engravings of eclipses, and the author's arguments are supported by astronomical calculations; which calculations are verified by making with them all the eclipses known to the ancients, in time and quantity as described by those who witnessed them. It has also a new arrangement of the four New Testament narratives in one combined narrative, giving all the occurrences of our Lord's life in chronological order.

— Mr. Townsend Mac Coun of this city has published "An Historical Geography of the United States," written by himself. It is a small quarto volume, containing more than forty maps illustrating the history of the country from its discovery to the present time. It opens with facsimiles of some of the maps made by European geographers during the sixteenth century and earlier, which show very clearly how difficult it was for them to get a correct idea of the form and size of this continent. Then follow maps illustrating the colonization of the United States and the early wars and national rivalries, and, last of all, a series in which the growth of the national domain from the close of the Revolution to the present time is clearly and strikingly shown. The maps are well engraved, and unencumbered with detail. A descriptive and historical text follows the maps, and adds to the usefulness of the book for study and for reference.

— It is now just two years since the *Academy* announced that Lord Carnarvon had found — among the papers which passed into his possession on the death of his mother-in-law, the late dowager countess of Chesterfield, widow of the sixth earl — a second series of "Chesterfield Letters," and that he proposed to edit them for publication. These letters, which number 236, are in an excellent state of preservation. They were addressed by the famous Lord Chesterfield, the fourth earl, to Philip Stanhope, his godson and successor in title, and may be regarded as a revised version of the celebrated letters to his natural son, who died after he had disappointed his expectations. The subjects are to a great extent the same: the language is often all but identical. But much of the cynicism of the earlier series has evaporated; the morality is on a higher level; the writer appeals to loftier principles than we are wont to associate with his name. The correspondence extends over nine years, beginning in 1761, when Philip Stanhope was in the sixth year of his age.

— Brown, Thurston, & Co., Portland, Me., announce the completion of the six volumes of the "York (Me.) Deeds." This work, which has been in progress for the past six years, is one of the most important historical and antiquarian publications relating to the early history of New England that has ever been published, being of particular value and interest to the people of Maine, New Hampshire, and Massachusetts, as in it is found a large portion of the unknown and unwritten history of those States. The work was done under the direction and patronage of the Maine Historical Society and the State of Maine.

— Of *The Ladies' Home Journal* it is said that it has the largest actual paid circulation of any magazine in the world; it had on its books at last count 422,356 paid annual subscribers, with a subsequent daily increase; it prints and sells each month 500,000 copies; it has two editions a year of one million copies each; it goes monthly into 35,000 post-offices throughout the United States and Canadian provinces; it has regular paid subscribers in 46 of the 60 countries of the civilized world; it has a subscriber in almost every English-speaking nation of the globe; it requires 8 large cylinder presses, running an entire month, to print a single edition; it has over 5,000 employees, agents, and subscription canvassers in its employ; it has a working staff of 80 writers and 14 editors, besides artists and engravers.

— In *Lippincott's Monthly Magazine* for January a feature of especial interest is the publication of the first part of some unpublished manuscript of Nathaniel Hawthorne's, — a weird tale entitled "The Elixir of Life." This is a version of the theme of "The Bloody Footstep," also treated by Hawthorne, in "Dr. Grimshawe's Secret," "Septimius Felton," "The Dolliver Romance," etc. Mr. Julian Hawthorne, who edits the manuscript, by drawing attention to the similarities and discrepancies between this and other versions, presents a study of the great romancer's methods of work, and, by paraphrasing such portions of the manuscript as are repeated in the published stories above named, imparts to the whole the character of a complete tale. "Nathaniel Parker Willis" is the theme of R. H. Stoddard's study of American authors. This paper is one of a series of critical articles which Mr. Stoddard has contributed to *Lippincott's*. In an article entitled "Newspaper Fiction," William Westall, the popular English novelist, tells of the growth of the syndicate idea in England. "The Theatrical Renaissance of Shakspeare" is contributed by Edward Fuller, the dramatic editor of the *Boston Post*, who reviews the extraordinary revival of Shakspeare's plays at our theatres during the season of 1888 and 1889. The article is full of suggestions concerning the setting of the plays, and also of criticisms upon modern actors. In "Under the Mistletoe," Henry Collins tells about the origin of the custom of kissing under the mistletoe; and Miss Anne H. Wharton, in "Our Winter Festivities," gives the origin of many of our Christmas and New Year customs.

— A. E. Kennelly, Mr. Edison's chief electrician, who has so frequently been called as an expert in important litigations, will contribute to the January *Scribner's* the sixth article in the electric series, entitled "Electricity in the Household," which is a popular discussion of the numerous devices that can be conveniently applied to every modern home where comfort is aimed at. The article will be illustrated. In his very interesting and timely article on "Water Storage in the West," Walter Gillette Bates discusses in the same number some of the reasons which may make it advisable that in the near future the government should undertake the whole question of reclaiming the arid regions of the West by an immense system of artificial dams and lakes. Of the Eiffel Tower, W. C. Brownell says, "It was, however, not only not vulgar, but agreeable. Technically the Tour Eiffel was superb. It may have been intended merely to be astonishing, but in reality it was in the highest degree impressive." In his article on "The Beauty of Spanish Women," Henry T. Finck says, "If I were asked to state in one sentence wherein lies the chief advantage of Spanish women over those of other countries, and to what they chiefly owe their fame for beauty, I should say, that if a Spanish girl has round cheeks, and has medium-sized, delicately cut nose and mouth, she is almost certain to be a complete beauty; whereas, if an American or English girl has a good nose, mouth, and cheeks, the chances are still against her having a beautiful complexion, and fine eyes, hair, and teeth, which Spanish girls are always endowed with as a matter of course. But over and above every thing else, it is the unique grace and the exquisite femininity, unalloyed by any trace of masculine assumption or caricature, that constitute the eternal charm of Spanish women."

LETTERS TO THE EDITOR.

***Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

The editor will be glad to publish any queries consonant with the character of the journal.

On request, twenty copies of the number containing his communication will be furnished free to any correspondent.

A Peculiar Case of Adhesion.

A VERY singular case of adhesive power has come under my notice lately, and the results of an investigation made with the view of establishing its nature are recorded in the following lines.

Mr. Louis Hamburger of Baltimore, sixteen years old, and of rather delicate build, noticed for the first time, about the middle of November last, that a cane would, as he expressed it, "stick" to his fingers, and that wiping off the cane and washing his hands would not prevent this occurrence. Laying his fingers on other light articles, such as lead-pencils, penholders, etc., he found that he could lift them up by simply placing his fingers upon them, the objects adhering firmly to the skin. Not being able to explain these phenomena, Mr. H. came to see me on Nov. 19, and surprised me by performing a few of the experiments which he had learned to execute, and which consisted in the raising of various objects by their adherence to his fingers. The heaviest of these articles did not weigh twenty grams.

At a loss to understand the nature of these phenomena, I began a series of experiments, which, in the course of a few weeks, brought to light a number of facts more interesting, and even more startling, than those which had been observed by Mr. H. himself up to the time he first called upon me. The experiments performed were made with the view of determining (1) the quality and nature of the adhering substances, i.e., their chemical composition and texture; (2) the quality or weight of adhering masses, and their relation to the hand's surface brought into play in a given experiment; (3) the exact points or surfaces of the fingers or other parts of the body which exhibit this adhesive power; (4) the length of time during which substances will adhere.

Before stating the results of the various experiments made, I will mention that it was soon found that the hands had to be carefully cleaned by washing with soap and water, and then with alcohol and ether, in order to attain the highest degree of adhesive power; and that the surface of the articles experimented upon had likewise to be well cleaned, and rubbed absolutely dry. Particles of dust or moisture greatly interfere in all experiments where the highest power is demanded.

In regard to the first point of inquiry, the nature of the material which would adhere, it was easily proven that chemical composition had nothing whatever to do with the adherence. Metals, stone, glass, rubber, wood, etc., — all probably adhere equally well, provided their surfaces possess the same degree of smoothness. As a general rule, it may be stated that the adhesive power increases with the degree of smoothness of surface. It is for this reason only that well-polished metals or glass show the highest degree of adhesion. The latter substance answers especially well, because it can be cleaned easily. In proportion as the surface becomes less even, the adhesive power diminishes; and porous substances, such as paper, cloth, etc., or articles covered with them, cannot be made to adhere at all.

The second question, regarding the determination of the extreme limit of the weight of matter adhering, was found more difficult to answer. A number of factors influence the results of experiments made in this direction. It was found that not only the shape of the adhering mass had to be considered, but also the position of the hand itself. Cylindrical forms seem to be preferable, while flat surfaces adhere but poorly; and a much larger weight may be attached to the fingers while the hand is held perpendicularly than

when in a horizontal position. In order to reach some definite results, glass rods of different diameters were used. They were so arranged as to allow an increase of their weights by attachments, and so that the hand might be applied in a perpendicular position. When first examined, on Sept. 22, it was found that the extreme limit of weight which could be made to adhere, by means of a glass rod of 10 millimetres diameter, to the surface of the front part of the four fingers of the right hand, when held perpendicularly, was 1,450 grams. A glass tube of 20 millimetres diameter was next substituted, and would yet adhere when its weight had been increased to 1,900 grams.

When the experiments were repeated on subsequent days, the same glass tube could each time be loaded heavier, and Mr. H. can now lift the comparatively enormous weight of 2,610 grams, after having pressed his fingers tightly to the glass rod, which stands in a perpendicular position upon a metallic disk to which it is fastened, and which also carries the weights.

I ought to state that the thumb is never used to cause the adhesion, and that, in commencing a series of experiments, Mr. H. can never at the beginning lift the greatest weight. It appears that the power of adhesion increases during a series of experiments made within a period of fifteen or twenty minutes. So far, the power has continued to increase almost from day to day, but appears to have now reached its maximum. Following are the results of a few of the experiments made as described above; the first figure representing the diameter of the glass tube (in millimetres), and the second the maximum weight suspended (in grams): 5, 1,530; 10, 2,120; 15, 2,400; 20, 2,610; 25, 2,260; 30, 1,860.

The weights recorded above are nearly one hundred times greater than those which can be lifted by adhesion when the corresponding tubes are used horizontally. Exact measurements of that portion of the hand's surface which comes in contact with the adhering mass are difficult to make. However, the determinations were made sufficiently accurately to show that very nearly 3 square centimetres surface enter into action during the adherence of a 20-millimetre rod, when supporting 2,500 grams.

When the investigation was first begun, Mr. H. not only firmly believed in his utter inability to use his left hand as he did his right, but also looked for the seat of the adhesive power only in the front part of his fingers. It has now been demonstrated that the left hand does all the work equally as well as the right one, and that the surface of adhesion extends, though different in intensity, over almost the whole of the inner part of the hands. The power is strongest in the front part of the fingers, and weakest in the centre of the palm and on that portion of the fingers which is nearest to it. All the protruding portions, including the ball below the thumb, possess adhesive power, however. Neither the back of the hands, nor other parts of the body, including the surface of the soles and toes, show any signs of adhesion. The power of the hand to sustain objects may be shown by suspending upon it, for instance, four 6-inch test-tubes alongside of one another, or by applying an iron rod, a wooden stick, and a glass tube simultaneously to different parts of the hand. A test-tube adhering to the hand may be made to roll to and fro by jerking the hand backward and forward while the tube is in a perpendicular position.

The intensity of adhesive power in the various fingers differs widely. It is strongest in the index and middle finger, and weakest in the little finger; the latter doing so little work, that the three others may lift almost as much as the four. What is most singular is that one finger possesses very little power. The greatest weight shown to adhere to one finger has been about 35 grams, while two fingers may lift 1,400 grams. In order to decide whether or not the aid given by a second or third finger, in balancing or steadying the weight of the suspended mass, was the cause of this inability of one finger to do much work, three fingers were covered with a thin film of collodion, which rendered them unfit to act by adhesion, but not by their muscular support.

The experiments thus performed showed conclusively that the three fingers covered with collodion were absolutely unable to assist the fourth one. It can therefore not be the steadying power which causes two fingers to do forty times the work of one finger. That this should be so, might have been inferred from the fact that Mr. H. can suspend a combustion tube about four feet long on two fingers, and cause it to swing like a pendulum through a distance of at least three feet.

The length of time during wnich substances adhere depends chiefly upon their weight. Light objects, such as test-tubes, will remain suspended even horizontally for ten minutes or longer, and can then be removed only by the application of some force, when a slight click, caused by the concussion of air, can be heard. Very heavy articles will fall off sooner; but whether in consequence of a diminution in the adhesive power of the surface, or in consequence of the strain exerted upon the muscles, it is difficult to say. Another cause of the falling-off is to be found in the perspiration which at times oozes freely from the pores, and interferes greatly with the experiments.

It may be added, that neither the shape of Mr. H.'s hands nor the structure of the skin, even when examined under a magnifying-glass, shows any thing abnormal, though the skin is very soft and smooth. These are the principal results of the investigation made, and the next question is, how to account for the phenomenon. I need not mention the reasons which exclude the possibility of an electric or a magnetic action, because the facts presented show this conclusively. We therefore seem to be limited to a consideration of surface action, or atmospheric pressure, or both. The reasons for this assumption are, (1) that it has been found impossible to notice any attraction whatever exerted at a distance; (2) that the power increases with the cleanliness and smoothness of the surface, i.e., with the number of actual points of contact; (3) that the peculiar sound heard on breaking contact is characteristic of the concussion of air; (4) that the power increases with the increase of surfaces in contact, as shown in the experiments with glass tubes of different diameters.[1]

Whether, or to what extent, the pressure of atmospheric air induces these phenomena, I am unable to say. I have not had an opportunity to examine Mr. H. under a diminished or increased pressure, but hope to do so ere long. Certain it is, that the ratio of one square inch of adhering surface to fifteen pounds in suspended weight has not been exceeded, though approached to within twenty per cent. But even if air-pressure participates, as it most likely does, we have to assume that the skin of Mr. H. is peculiarly fitted to show these phenomena of skin-adhesion, and in a degree, to my knowledge, unnoticed heretofore. That he is not the only person possessing this power, I have good reason to believe. Among a large number of people examined, there were many whose hands showed at least signs of this power, and certainly a few who promised to develop it sufficiently to exclude doubt in regard to the occasional existence of the force. It may be well to warn persons who may try experiments, not to mistake for actual adhesion the suspension of tubes by means of counter-pressure exerted by portions of the terminal phalanges or the fleshy portions surrounding them. The unmistakable sign of adhesion is the performance of the experiments with the fingers kept absolutely close to one another, in which case it becomes next to impossible to exert counter-pressure. That muscular action may come into play in some of Mr. H.'s experiments is not absolutely impossible, yet very doubtful. I leave it to physiologists to furnish a more satisfactory explanation of these phenomena than I myself have so far been able to give.

W. SIMON, PH.D.

Baltimore, Dec. 16.

Convectional Currents in Storms.

READERS of *Science* will remember, that, in the numbers for May 10 and June 21 of the current year, there were given some computations of the probable effect of convectional currents and of the condensation of moisture carried by them into the cooler air strata above. These computations showed that there could be no liberation of energy from any such action. An interesting article has appeared in the *American Meteorological Journal* for December from the pen of Professor Davis of Harvard University, in which I find, "It is difficult to understand why this question should be so confused by Hazen, as appears in his recent articles. . . .

[1] That there is a decrease in power when the tubes are wider than 20 millimetres may be explained by the fact that those surfaces of the fingers which show the highest degree of adhesion are prevented from coming in proper contact with the surface of tubes, when of too large a diameter. This would account also for the poor adhesion of objects with flat surfaces.

It is a mistake to say that latent heat thus liberated [from the condensed moisture] will warm the air enough to allow the condensed vapor to evaporate again; for the latent heat is completely expended in the work of pushing away the air that surrounds the ascending expanding mass, and therefore cannot be applied to any other task. Espy made this error for a time, but afterwards corrected himself. It is regrettable to see the error now revived by Hazen." As all these computations were based on commonly accepted theories, it is a little difficult to comprehend these expressions. I hope to show that the confusion is where it is least suspected. I am aware that the ordinary theories have such a fascination, there is little hope in bringing the philosophers who accept them to what the facts seem to indicate; but there are an increasingly larger number of persons who have grave doubts as to the sufficiency of present meteorological inferences to account for the facts observed, and it is for these I write, as well as to explain my position.

The fact that there is no exchange of air *en masse* from one level to another has been proved by the strongest arguments, and such as have not been controverted. It is a great pity that this assumption should be boldly made at this day without answering the objections. It seems high time to lay aside "glittering generalities," and carry out our analyses to the actual conditions we observe. To do this it is only necessary to set forth quantitative computations of the effects produced by certain inferences. I am not aware that this has been attempted save once (see *Science*, xiii. p. 369). In that case the assumptions and results were so absurd and so easily controverted, that it is not surprising that no philosopher has taken up that line since.

There are two points to be made plain. First, regarding "work." This is the great shibboleth of theoreticians. If there is a troublesome quantity of heat to get rid of, or the formation of vapor which is the source of energy to account for, "work," and the difficulty disappears. If we place *a* pounds of gunpowder in a cannon, and discharge a ball upward, a certain number (say, *b*) of foot-pounds of work is done, and this can be definitely computed. If a similar amount of gunpowder be strewed over a field, there is, what we may call, the same potential energy present as before; but no one believes that firing the powder will carry a shot, or that a single foot-pound of effective work will be done by it. This would appear one of the most serious defects in modern theories. The philosopher sits down, draws on his thinking-cap, and, seeing rain falling at the rate of two inches per day, in a twinkling finds that 11,796,000 cubic inches of water is condensing over a single acre. Next he finds a million times that in an ordinary storm, and this represents billions on billions of foot-pounds of energy. Is not this the veriest nonsense? What these theoreticians need most of all is to transport their steam-engine, if they can find one, into the cloud region, and then compute the amount of work actually made effective. No one, outside of these philosophers, would boil away tons of water in the open air on the Atlantic coast, and imagine by this means to obtain effective energy enough to transport a great steamer across the ocean in less than six days.

A word regarding the "using-up of the latent heat of condensation by doing work in pushing aside the air which surrounds the ascending expanding mass." Nothing can better illustrate the views just enunciated than this inference. It is universally accepted that air blows toward our storms almost normally to the isobars at the outside, but more and more at an angle as it approaches the centre, till it becomes tangential at ten to two hundred miles from the centre. This whirling column has, it is also inferred, an upward convectional movement at the centre. It is impossible for us to imagine that there is a central core, forming a convectional current, and that on all sides of this there is a vertical cylinder of air pressing in on the core, and which must be pushed aside; for just beyond this core the air is whirling in the same circle, and it is believed by some that the centrifugal effect would even throw this outward. This shows conclusively that there is absolutely no air to push aside, and, even if there were, the work needed to move it in a frictionless medium would be inappreciable. Is not this inference a most weak attempt to bolster up an exceedingly weak theory?

It is probable that the old inference that the sun heats up a limited portion of the earth's surface, and sets up a convectional current which ultimately results in a violent tornado, will soon disappear. Professor Ferrel, one of the most ardent advocates of this inference, has recently declared, that, in order that this convectional current may not be broken up from the greater speed of the upper portion, it is necessary to suppose that the upper part separates from the lower, advances in front of the storm, and sends its gyrations through a frictionless medium to the earth. Verily, to use a homely but forcible and apt expression, "this is cutting off the tail of this theory close behind its ears."

It is now known that the sun's heat has no direct effect upon air-columns near the earth. We know,

1st, That the earth becomes very hot, but the air is almost a non-conductor of this heat; and this effect extends only a few inches.

2d, That convectional currents occur only between contiguous air strata, and there is no transport of air *en masse* by them.

3d, On some days the air is heated thirty or more degrees above the morning temperature; but this produces no effect on the moisture contents of the air, it does not produce any convectional current, and the heat extends over a circle about a thousand miles in diameter.

4th, As a storm approaches, clouds cover the sky, and the direct effect of the sun's heat is almost entirely removed.

5th, Notwithstanding the removal of the sun's direct influence, the moisture in the air is most remarkably affected. We find enormous additions to this moisture over a region extending for hundreds of square miles in front of the storm. Whence comes this moisture? We have indubitable evidence that heat has nothing to do with it. Its occurrence is entirely independent of the winds. It does not descend from above, for there is ordinarily less moisture there than below, and theory indicates an upward and not downward motion. It seems to me this is one of the most important points to be determined. It would seem that the moisture collects in the upper regions before the storm, for the first indication of the storm is the high cirrus four hundred or five hundred miles in advance. This shows plainly that the origin of the storm is not from convectional currents beginning at the earth's surface. Is there a condition in the atmosphere which is so changed upon the approach of a storm that the air begins to absorb moisture? Is there an influence from the sun that only requires a slight change on the advance of a storm to cause the moisture to mass itself? Is there a condition in front of the storm itself that attracts moisture directly without its transport by air or heat currents? Does the moisture come from the whole region near the storm, and mass itself at it? These are startling hypotheses, but they have much to support them. Our storms come over the arid plains of the West with little moisture in them. Almost suddenly, as they approach the more fertile valleys, there is a marked increase in the moisture. Light rain begins, which becomes heavier the farther east the storm moves. At times the storms move clear across the country without depositing much moisture. Is this because the attractive force has less power, or because it holds the moisture more tenaciously, or because the air is too dry to allow precipitation? We have here what seems a most important field of research, and one that promises much. H. A. HAZEN.

Washington, Dec. 13.

INDUSTRIAL NOTES.

Calendars.

AT this season, when every one is looking for a convenient calendar for use during the coming year, there should not be overlooked the various very attractive calendars, issued as advertisements, it is true, but in which the advertising feature is not introduced in a way to make the calendar objectionable. Among these we have just seen that issued by the well-known firm of C. I. Hood & Co., of sarsaparilla fame. This calendar can be had for the asking at any druggist's, or is sent postpaid on receipt of 6 cents in stamps at the main office of the firm in Lowell, Mass. The head of a young girl lithographed in fourteen colors appears on the face of the card, and is an admirable example of what can be done in this line of art. It is a very pretty bit of color to brighten up some dark spot.

CALENDAR OF SOCIETIES.

Biological Society, Washington.

Dec. 14. — C. Hart Merriam, Results of a Biological Survey of the San Francisco Mountain Region in Arizona; C. D Walcott, A New Genus and Species of Ostracod Crustacean from the Lower Cambrian; A. F. A. King; On the Flight of Young Birds.

Connecticut Academy of Arts and Sciences, New Haven.

Dec. 18. — Professor Hastings, A Visit with the Jena Opticians.

Boston Society of Natural History.

Dec. 18. — Frederick Tuckerman, Gustatory Organs of Mammals; S. H. Scudder, Fossil Plant-Lice.

Mineral Lands.

MANGANESE DEPOSITS. — A rich deposit of Manganese is for sale. Apply to H. N., care of *Science*, 47 Lafayette Place, New York.

GOLD-BEARING QUARTZ VEINS. — Any one wishing to engage in gold mining will learn of a newly discovered vein by applying to H N., care of *Science*, 47 Lafayette Place, New York.

RED SLATE. — A valuable deposit of red slate for sale. Apply to H. N., care of *Science*, 47 Lafayette Place, New York.

Wants.

Any person seeking a position for which he is qualified by his scientific attainments, or any person seeking some one to fill a position of this character, be it that of a teacher of science, chemist, draughtsman, or what not, may have the 'Want' inserted under this head FREE OF COST, *if he satisfies the publisher of the suitable character of his application. Any person seeking information on any scientific question, the address of any scientific man, or who can in any way use this column for a purpose consonant with the nature of the paper, is cordially invited to do so.*

MATHEMATICS AND MODERN LANGUAGES. — Wanted, a teacher to teach Mathematics and Modern Languages. Place must be filled before Jan. 8.—Carl A. Harstrom, Vineland Preparatory School, Peekskill, N.Y.

I WILL ASSIST in photographic or optical laboratory in return for experience and convenience of perfecting original appliances. Address E. C. Owen, care of Gibson & Simpson, 9½ Adelaide Street East, Toronto, Canada.

AN ANALYTICAL CHEMIST is open to an engagement in mining, metallurgy, calico-printing, and bleaching, or as research chemist in alkali manufacture. Address "Alkali," care of SCIENCE.

CHEMIST. — A young man of twenty-three, lately a special student of chemistry in the Scientific Department of Rutgers College, desires a position as assistant in some chemical works. Address, B. G. D., 526 Cherry St., Elizabeth, N.J.

TEACHING.—A young man desires a position to teach the Natural Sciences, Botany in particular, in a High or Normal School or Institute. Can also teach first Latin and German. Best of references given. Address "E," care of *Science.*

A GRADUATE OF THE JOHNS HOPKINS UNIVERSITY desires a position as teacher of physical science. Specialty, chemistry, for which he refers to Prof. Remsen by permission. Address B. H. H., care of *Science.*

WANTED.—To correspond with conchologists in America, especially in California, with a view to exchange. Many British land, fresh water, and marine duplicates; some foreign. Address Mrs. FALLOON, Long Ashton Vicarage, Bristol, England.

TEACHER OF NATURAL SCIENCE.—A young lady desires a position as a teacher of Natural Sciences, especially Chemistry and Physics. One year's experience. Testimonials given. Address Miss J. S., No. 31, N. Hanover St, Carlisle, Pa.

WANTED a young man with some knowledge of mineralogy to assist in our Mineral Department. A. E. FOOTE, 1223 Belmont Av., Philada., Pa.

COLLEGE ALUMNI AND PHYSICIANS. — The American Academy of Medicine is endeavoring to make as complete a list as possible of the Alumni of Literary Colleges, in the United States and Canada, who have received the degree of M.D. All recipients of both degrees, literary and medical, are requested to forward their names at once to Dr. R. J. Dunglison, Secretary, 814 N. 16th Street, Philadelphia, Pa.

A YOUNG MAN can have lucrative engagement, not only a fixed salary, but according to his work accomplished in travelling for SCIENCE. A personal interview invited.

N. D. C. HODGES,
47 Lafayette Place, New York.

A YOUNG SCOTCHMAN desires an appointment in America. Three years in English Government Office. Good references. Address "Jack" care J. Lawson & Coy, 17 Princes St., Aberdeen, Scotland.

PHYSIOLOGY AND HYGIENE. — A Fellow of the Mass. Med. Society, Member of the Suffolk District Medical Society, and former Assistant Editor of The Annals of Gynæcology, desires a position as instructor in Physiology and Hygiene. Address "N," 47 Lafayette Place, N.Y. City.

MECHANICIAN.—An optician and maker of instruments of precision of experience would be glad of a position where his skill would be valued in connection with some higher educational institution. Address G. J., care of SCIENCE, 47 Lafayette Place, New York.

SCIENCE-TEACHING. — A specialist in science-teaching, physics, chemistry, and physiography desires an engagement, preferably in a high or a normal school. Is well known as an author of several popular text-books. Address X., care of SCIENCE.

WANTED.—Information concerning the handling of air from Caves, for Cooling and ventilating rooms. Address "M. H." care of *Science* 47 Lafayette Place, N.Y.